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Imperial Japanese Navy Aircraft Carriers 1921–45



Mark Stille • Illustrated by Tony Bryan

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INTRODUCTION

During the opening period of the Pacific War, the Imperial Japanese Navy possessed the most powerful carrier force in the world. By virtue of a potent combination of excellent ships, well-designed aircraft, and unsurpassed aviators, the Imperial Navy's carrier force recorded a string of victories from Hawaii to the Indian Ocean. Even after the crushing defeat at the battle of Midway in June 1942, Japanese carriers continued to give a good account of themselves during the ferocious battles off Guadalcanal during the second half of 1942. Only with the eventual elimination of the last of their highly trained aircrews were the Japanese carriers rendered powerless to interfere with the US Navy's march to the Japanese homeland.

This book provides a short account of the 25 carriers that saw active service in the Imperial Navy during the Pacific War. Those ships that were not completed are not covered. Likewise, seaplane carriers are not discussed. The late-war conversion of two battleships into hybrid carriers is left for another volume in this series.

JAPANESE CARRIER DEVELOPMENT

The Imperial Navy's aviation program developed in broad parallel with those of the Royal Navy and the United States Navy. By 1913, the Japanese were impressed enough with the potential of naval aviation that a naval transport, *Wakamiya Maru*, was fitted to carry two seaplanes

The Imperial Navy was the first navy to concentrate carriers to increase their striking power. Shown here are two of the six carriers used in the Hawaiian operation. The aircraft in the foreground are D3A dive-bombers. (US Naval Historical Center)





The A6M fighter was a formidable air superiority fighter, but was less well suited for fleet air defense. Here, A6Ms are ready to launch during the Hawaiian operation. (National Archives)

and was used in fleet maneuvers. In 1914, after Japan's entry into World War I, aircraft from *Wakamiya Maru* took part in the Japanese seizure of German territories in China. During the war, Japanese naval observers with the Royal Navy allowed Japan to keep abreast of developments in the world's leading aviation navy.

Through their own experience with *Wakamiya Maru* and their observation of the Royal Navy, the Japanese realized the importance of aircraft carriers and the requirement for a modern navy to incorporate naval aviation. Accordingly, the Fleet Programs of both 1918 and 1920 provided for the construction of carriers. In 1920, the Japanese asked their British ally for technical assistance in developing their naval aviation program. Between 1921 and 1923, the Royal Navy mission sent to assist the Japanese proved indispensable in the development of the Imperial Navy's carrier force. All aspects of naval aviation were advanced, from training and design details for the first Japanese carrier to design and construction of naval aircraft.

The Washington Naval Treaty of 1922 greatly affected Japanese carrier design and construction, as it imposed a limit on the size and number of aircraft carriers allowed. The treaty limited new construction ships to a displacement of 27,000 tons. Conversion of two existing capital ships into carriers was permitted and these could be up to 33,000 tons. Under the treaty, the total carrier tonnage allowed to the Imperial Navy was 81,000 tons; this meant that the Japanese were placed in a position of inferiority, as the US and Royal Navies were each permitted 135,000 tons. Until the restrictions were lifted in 1936, the Japanese were continually scheming to maximize the utility of their allotted tonnage while also attempting to maintain numerical parity of carriers with the US Navy.

During this time, Japanese carrier doctrine was also in flux, which also affected ship design. The Imperial Navy first saw the role of its carriers as providing spotting, reconnaissance, and anti-submarine patrol to the main battle fleet composed of the undisputed arbiters of naval power, the battleship. By the early 1930s, aircraft technology had

reached a point where carriers were viewed as viable striking platforms in their own right and were given an important role in the Imperial Navy's attritional strategy that required light units and aircraft to reduce the size of the larger US Fleet before the decisive clash of battleships took place on equal terms. The main target of carrier aircraft was now determined to be enemy carriers. Destruction of the enemy's carrier force would then allow Japanese carrier aircraft to weaken the enemy's battle fleet. Because carriers were seen to be very vulnerable to attack, the essential precondition for carrier combat was that the Imperial Navy strike first. This accounts for the great Japanese emphasis on large carrier air groups composed of aircraft uniformly lighter than their opponents, giving them greater range.

As the importance of carrier combat was recognized, the issue of how the Imperial Navy's carriers were to be used was much debated. Should they be massed for greater striking power and a greater defensive capability, or should they be dispersed to enhance their survivability? Eventually, even though it was feared that massing them in a single force would expose them all to a crippling attack, the advocates of concentration prevailed. In April 1941, the First Air Fleet was created, and by December of the same year this force was used to deliver an ambitious pre-emptive attack against the US Pacific Fleet. The Imperial Navy's carrier force had been welded into a weapon of unprecedented power.

AIRCRAFT, AIRCRAFT OPERATIONS, AND AIRCRAFT HANDLING FACILITIES

By the start of the Pacific War, the Japanese had six fleet carriers in service supported by three smaller units. Also in service was a world-beating carrier fighter (the A6M, Allied codename "Zeke"), the world's best carrier torpedo aircraft (the B5N, "Kate") and a very accurate carrier dive-bomber (the D3A, "Val"). These aircraft, combined with well-trained and experienced aircrews and deck crews, combined to make the Imperial Navy's carriers into formidable striking platforms.

The aircraft capacity of Japanese carriers was determined by hangar space. Unlike on US Navy carriers, all aircraft servicing, refueling, and weapons reloading was done in the hangar. Japanese carriers did not maintain a deck park of aircraft. This practice, and the fact that only the B5N had folding wings, meant that Japanese carriers did not usually possess the aircraft capacity of US carriers.

When launching aircraft, operations were directed by the Air Operations Officer positioned on a platform on the rear of the island. To launch aircraft, the carrier turned into the wind and steamed at full speed. Between 20 and 30 seconds were needed for each aircraft launch. Lighter aircraft were spotted forward to take off first, as they needed less of a flight-deck run to become airborne. An A6M could take off in a mere 230 feet in the right wind conditions; heavier aircraft needed twice that distance. Unlike US and Royal

The torpedo-armed B5N was a potent ship-killer. It was also used in a horizontal bomber role. (US Naval Historical Center)



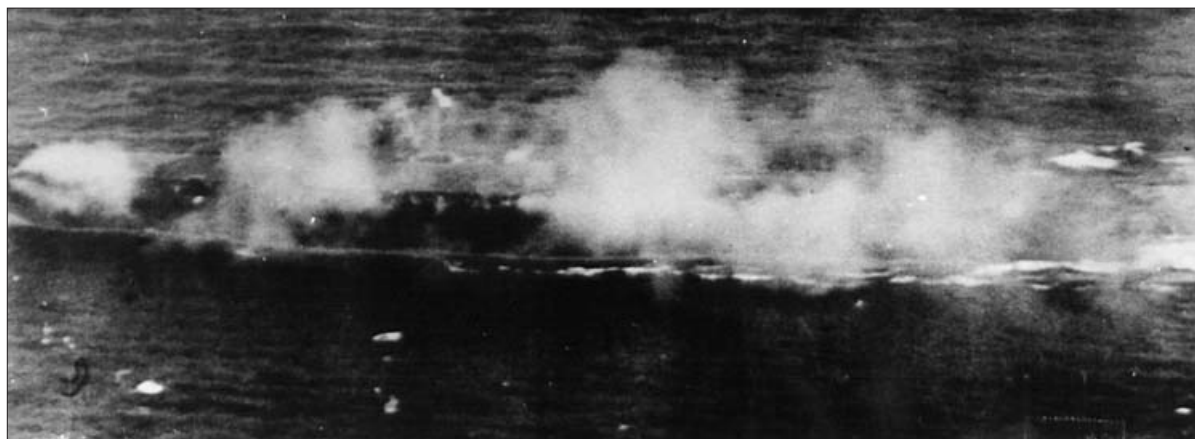


Shokaku ready to launch a strike during the battle of Santa Cruz. The A6M fighters are spotted forward with the heavier strike aircraft spotted further aft. (US Naval Historical Center)

Navy carriers, Japanese carriers were never equipped with catapults to assist in aircraft launching. Use of catapults would have allowed a greater number of aircraft to be ranged on the flight deck for launch, thus allowing larger strikes to be flown. Given the lighter weights of Japanese early-war aircraft, the lack of catapults did not affect operations until later in the war, when heavier aircraft began to enter service.

A proficient Japanese carrier could recover an aircraft every 25–45 seconds. Japanese pilots were not guided down to the ship's deck with the assistance of a landing signals officer, as was the case for American and British carrier pilots. Japanese carriers were equipped with a system of approach lights that assisted the pilot in judging his angle of approach. Though it was not stabilized to compensate for the movement of the ship in a heavy sea, it proved successful and was used throughout the war. Japanese fleet carriers had up to nine arresting wires placed in the rear portion of the flight deck. By the start of the Pacific War, carriers were equipped with the Kure Type 4 arresting system that used an electric engine and could stop an 8,000lb aircraft in about 130 feet. Forward of the arresting wires was a crash barrier. This protected any aircraft parked on the forward part of the deck from an aircraft that failed to catch one of the arresting wires. This innovation greatly speeded up aircraft recovery. Once aboard, aircraft had to be moved quickly down to the hangar deck for maintenance, refueling, and rearming; the size and placement of elevators was a key factor in aircraft handling. Japanese carriers used aircraft elevators driven by electric motors. On fleet carriers, there were usually three elevators, all located on the ship's centerline (or just off centerline). Because most Japanese aircraft did not have folding wings, Japanese aircraft elevators were larger than those on carriers of the US and Royal Navies.

Hangars on Japanese carriers were unarmored, as was the flight deck. Most fleet carriers featured two hangars, each usually between 13 and 16ft tall and placed one above the other. Outboard of the hangars were areas dedicated to aircraft maintenance. The sides of Japanese carrier hangars were designed to vent the force of a bomb exploding on the hangar deck outwards instead of upwards, which could render the flight deck useless. In practice, the opposite frequently occurred, as the result of a bomb hit on the hangar deck was a ruptured flight deck. This design flaw was apparent throughout the war. Only the introduction of two late-war carriers with armored flight decks addressed this key vulnerability.



Japanese aircraft carriers received large numbers of anti-aircraft guns as the war progressed. *Zuikaku*, shown here under attack during the battle of Leyte Gulf, was equipped with 96 25mm guns, but was still overwhelmed and sunk by air attack. (US Naval Historical Center)

This faulty hangar design was worsened by the fact that hangars were not flash or vapor tight. To ventilate the hangar, Japanese carriers used intake and exhaust fans. Fires on the hangar deck were an obvious danger that the Japanese planned to combat with a foam spray system using rows of pipes and nozzles on the hangar walls. In addition to the faulty hangar design, aviation fuel handling arrangements on Japanese carriers were dangerously inadequate. Fuel tanks were part of the structure of the ship, which meant that shocks to the hull were also absorbed by the tanks, creating possible leaks. Combined with the inability to vent these fumes from the hangar, the potential for disaster was obvious.

To make things worse, damage-control training on Imperial Navy ships was generally poor. Organizationally, damage control was not given proper priority. These factors, combined with the design flaw of enclosed hangars and a vulnerable fuel system, meant that Japanese carriers could be characterized as ships with great striking power but with limited ability to take damage.

CARRIER SHIPBOARD WEAPONS

As the Pacific War developed, the Imperial Navy was increasingly exposed to air attack. In response, the Japanese greatly augmented the anti-aircraft protection of their surface ships, carriers included. However, in spite of the increased number of guns onboard the carriers, the vulnerability of Japanese ships to air attack increased and proved a decisive weakness as the war progressed.

Two primary guns were mounted on Japanese carriers for air defense. The primary heavy anti-aircraft gun was the Type 89 5in/40-caliber dual mount that was successfully tested for fleet use in 1931. It was a respectable weapon and was used on a variety of other surface ships and also as a coast defense gun in both anti-aircraft and anti-surface roles. The weakness of this weapon was not its performance, but its fire-control system. The Type 94 fire-control director was very reliant on manual inputs and control and thus was generally unsuited for tracking fast targets. Compounding this was the fact that the Japanese never developed any sort of proximity fuse, as used with great effectiveness by the US Navy against Japanese aircraft.

TYPE 89 ANTI-AIRCRAFT GUN

Size:	5in
Shell weight:	51lb
Muzzle velocity:	2379ft per second
Max elevation:	+90 to -8 degrees
Max range:	16,075yds/30,970ft max ceiling
Rate of fire:	8 rounds per minute

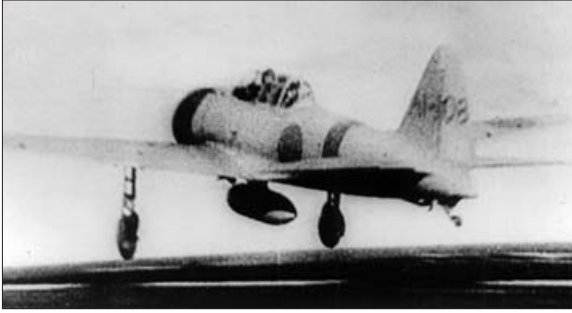
As undistinguished as the Type 89 proved to be in service, the Imperial Navy's selection of its light anti-aircraft gun proved to be a disaster. The standard light anti-aircraft gun of the Pacific War was the Type 96 25mm. Initially, the Type 96 was introduced as a double mount; the triple mount version entered service in 1941 and was followed by a single gun mount. The 25mm gun was an adaptation of a French Hotchkiss design. Unfortunately for the Imperial Navy, it was a weapon with a relatively low rate of fire and which used a projectile with insufficient hitting power to destroy increasingly rugged American aircraft. Though it had a nominal rate of fire of 200–260 rounds per minute, the reload system that required ceasing fire when a 15-round clip was exhausted reduced the actual rate of fire to approximately 130 rounds per minute. Additionally, the weapon had a slow training and elevating speed. The Type 96 could be controlled manually or by the Type 95 director, which was considered state of the art when it was introduced in 1936. However, in service, the Type 95 proved unable to track modern aircraft, and when the excessive smoke, muzzle flash, and recoil of the Type 96 gun was considered, Japanese anti-aircraft gunnery was generally inaccurate. The lack of effective anti-aircraft protection and a faulty doctrine for the use of escorting ships in defending the carriers meant that the best hope for survival of a carrier under air attack was usually the maneuvering skill of its captain.

TYPE 96 ANTI-AIRCRAFT GUN (TRIPLE MOUNT)

Size:	25mm
Shell weight:	.6lb
Muzzle velocity:	2953ft per second
Max elevation:	+85 to -10 degrees
Max range:	8,200yds/18,040ft max ceiling
Rate of fire:	200–260 rounds per minute (per gun)

CARRIER RADAR AND FIGHTER DEFENSE

The Imperial Navy's radar program was far less developed than that of the Allies. The tardy introduction of radar and its ineffective use was perhaps the single biggest weakness of the Imperial Navy during the Pacific War. While the use of radar greatly strengthened the air defense of American ships, the lack of effective radar was devastating to Japanese aircraft carriers.



Each Imperial Navy fleet carrier carried a dedicated fighter unit equipped with A6M aircraft. At the start of the war, a fighter unit was assigned 18 aircraft. This was increased after the battle of Midway to 27 aircraft. (US Naval Historical Center)

No Japanese carrier or any other ship began the war fitted with radar. This made the task of controlling defending fighters very difficult. In the early war period, Imperial Navy fleet carriers embarked a fighter squadron with 18 aircraft. These aircraft were usually divided into a nine-aircraft division to accompany outgoing strike aircraft and another nine-aircraft division to provide air defense for the ship and its escorts. With no radar, air defense was accomplished by conducting standing patrols. However, only a few aircraft (usually a section of three) would be airborne at any time, with the remaining aircraft standing by to be scrambled if adequate warning was gained. Adding further difficulty to the fighter defense problem was the inferior quality of Japanese aircraft radios which made it virtually impossible to control aircraft already airborne. Even when carriers received radar late in the war (the first carrier to receive radar was *Shokaku* in 1942 when the ship received the Type 21 radar), the Japanese were never able to maximize their fighter assets by integrating all incoming information into what the US Navy called a Combat Information Center.

Two primary types of radar were used on Japanese carriers; however, the first carrier did not receive any radar until after the disastrous battle of Midway. The first radar introduced was the Type 21. On carriers with an island, it was mounted atop the island; on other ships it was placed on the flight-deck edge and the control room and radar antenna were lowered flush with the flight deck when aircraft operations were under way. Performance was mediocre, with the ability to detect a group of aircraft at approximately 60 miles and a single aircraft at about 45 miles. The Type 13 anti-aircraft radar was mounted on many Japanese ships, including carriers, as approximately 1,000 were built. Performance was similar to the Type 21, with the capability to detect a group of aircraft at 60 miles and a single aircraft at 30 miles. The Type 13 was light, but long, and was mounted on the mainmast or radio masts of carriers.



***Junyo* was equipped with both Type 21 and Type 13 radar. The Type 21 is the mattress spring antenna forward of the stack, and the Type 13 is mounted on the mainmast aft of the stack. (US Naval Historical Center)**



CARRIER NAMES

Japanese carriers were given poetic names based on flying creatures. There were several exceptions, but these were ships that were converted into carriers and retained their original names.

PRE-WAR-BUILT CARRIERS

Hosho (Flying Phoenix)

Design and Construction. The Imperial Navy's first carrier was not the first ship to be designed as a carrier from the keel up, as is often stated. *Hosho* was laid down as a mixed seaplane carrier/aircraft carrier employing both seaplanes and deck-launched aircraft. The ship was modified during construction and was completed as a full-deck aircraft carrier based on a light cruiser hull. She was launched in November 1921 and commissioned into service in December 1922. With a narrow beam and a 300ft hangar, only 21 aircraft could be carried. This was later reduced to 11 as aircraft got larger.

Service Modifications. The most obvious modification occurred early in *Hosho's* career. A small starboard-side island was found to impede aircraft operations on such a narrow deck and was removed. Navigation was now accomplished from two platforms mounted on either side of the forward edge of the hangar. During the Pacific War, *Hosho* was relegated to secondary duties in home waters and was therefore only slightly modified. The flight deck was lengthened and widened in 1944 to facilitate its role as a training carrier.

Hosho on its speed trials in November 1922. As completed, the ship was equipped with a small island, but it proved unsuccessful in service and was removed. The three small stacks are shown in their normal position. When flight operations were being conducted, they were swiveled 90 degrees parallel with the flight deck. (*Ships of the World*)

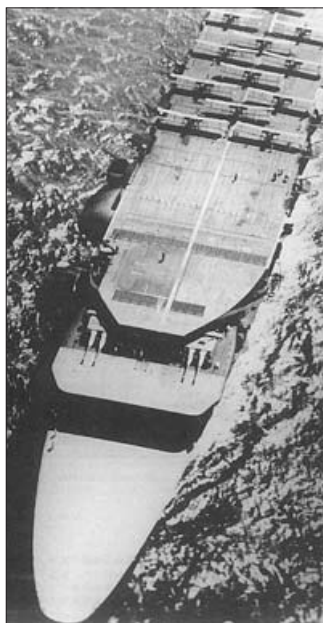


Hosho in October 1945 after its surrender. The widened and lengthened flight deck is evident and now extends well over the ship's bow and stern. The landing-light system can be seen on both sides of the stern. Camouflage of both the hull and the flight deck can be faintly made out. (*Ships of the World*)

View from the forecastle of *Hosho* after its surrender, showing the narrowness of the flight deck and the general light standard of construction. (US Naval Historical Center)



Akagi in 1929 just after the installation of the two 8in turrets on the middle flight deck. The difficulty of flying aircraft off the lower two flight decks can be easily imagined. (*Ships of the World*)



Armament. When completed in 1922, little consideration was given to anti-aircraft defense, and the ship was equipped for defense primarily against surface attack. Accordingly, four 5.5in guns were mounted outboard of the hangar and two 3in AA guns were positioned on the flight deck. As war neared, only the 3in guns remained; these were removed at the start of the war, and eight 25mm AA guns were fitted. The number of 25mm guns was increased to 30 by 1944. When surrendered in 1945, only six 25mm guns remained.

Operational History. During the Sino-Japanese War of 1937–40, *Hosho* was active in operations off the China coast. Of marginal usefulness by the opening of the Pacific War in 1941, *Hosho* was employed in a few minor operations before she participated in the battle of Midway as an escort to the battleship-heavy Main Body. Afterwards, *Hosho* returned to the Inland Sea and was used as a training carrier for the remainder of the war. *Hosho* survived the war and was used for repatriation duties before being scrapped in 1947.

HIJMS (HIS IMPERIAL JAPANESE MAJESTY'S SHIP) *HOSHO*

Displacement:	7,470 tons
Dimensions:	Length 579ft (1944)
	Beam 59ft
	Draft 20ft
Maximum speed:	25kts
Radius:	8,680nm
Crew:	550

***Akagi* (Red Castle – an extinct volcano in the Kanto area near Tokyo)**

Design and Construction. After its experience with *Hosho*, the Imperial Navy decided it needed carriers with a larger aircraft capacity that had the speed to operate with the fleet. As a result of the Washington Naval Treaty, a number of incomplete battlecruisers were slated for scrapping. Their large hulls and high speed made them ideal platforms for conversion into carriers. In 1923, conversion began on battlecruiser *Akagi*. What emerged

in 1927 demonstrated the evolving nature of Japanese carrier design. *Akagi* possessed a flight deck of 632ft but no island. There were two hangars; each had its own flying platform forward. This arrangement allowed 60 aircraft to be carried.

Service Modifications. Not surprisingly, *Akagi*'s multi-level flight-deck arrangement proved impractical and she was removed from service in 1937 for modernization. This was extensive and saw the removal of the two lower flight decks and the lengthening of the main flight deck to 817ft. The hangars were also lengthened (aircraft capacity being increased to 66 plus 15 reserves) and a third elevator was added. A small island was also added. The formerly complex stack arrangement was reduced to a single downward-facing stack on the starboard side, a common design feature on most subsequent Japanese carriers.

Armament. Completed with a total of ten 8in guns, after the 1937–38 reconstruction *Akagi* still retained six 8in guns mounted in casemates. Placed low to the water, they were virtually unusable in any kind of sea. Anti-aircraft protection was strengthened and now totaled 12 4.7in anti-aircraft guns in dual mounts (*Akagi* was the only fleet carrier not to receive the newer Type 89 5in anti-aircraft guns) and 14 twin 25mm guns. *Akagi* maintained this configuration until her loss in 1942. No radar was ever fitted.

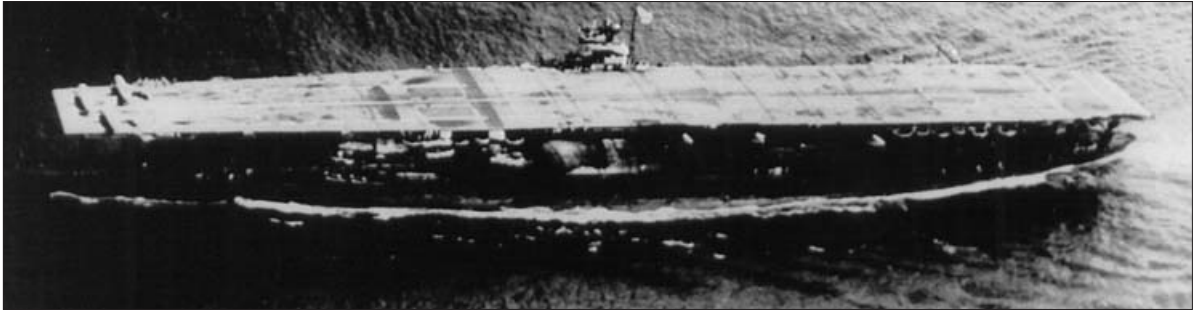
Operational History. The wartime exploits of *Akagi* made her the most famous Japanese carrier. *Akagi* served as the flagship of the First Air Fleet and led the Imperial Navy's carrier fleet during the war's first six months. During this time, *Akagi* and its elite air group devastated Allied forces at Pearl Harbor, Rabaul, the Dutch East Indies, Port Darwin, and Ceylon. At Midway, on June 4, 1942 American dive-bombers from USS *Enterprise* caught *Akagi* with fully fueled and armed aircraft on its deck. Hit by two bombs, the resulting fires raged out of control and resulted in the ship being scuttled the following day.

HIJMS AKAGI (AFTER 1938 RECONSTRUCTION)

Displacement:	36,500 tons
Dimensions:	Length 855ft
	Beam 103ft
	Draft 29ft
Maximum speed:	31kts
Radius:	8,200nm
Crew:	2,000

Akagi in 1939 after modernization. (US Naval Historical Center)





Japanese fleet carriers embarked three squadrons: one dive-bomber, one attack (torpedo), and one fighter. At the start of the war, *Akagi's* air unit was assigned 18 A6M fighters, 18 D3A dive-bombers, and 27 B5N attack planes. Shown here are several fighters spotted forward on *Akagi* before the start of the war. The port side island makes the ship easily recognizable. (US Naval Historical Center)

***Kaga* (a former province of Japan)**

Design and Construction. Earmarked for scrapping under the Washington Naval Treaty, *Kaga* received a new lease on life when the battlecruiser *Amagi*, earlier slated for conversion to a carrier, was damaged in the 1923 Tokyo earthquake. *Kaga* was substituted and work began in late 1923. Though the hull of the battleship was over 60ft shorter than *Akagi's*, upon completion *Kaga* possessed the same general layout as *Akagi*. Because the hangars were extended and were wider, the same number of aircraft could be carried as on *Akagi*. However, the larger beam and less powerful machinery on *Kaga* resulted in a slower speed than any other Imperial Navy fleet carrier, only 27.5 knots.

Service Modifications. As with *Akagi*, the multi-level flight-deck arrangement proved impractical. After just over four years in service, *Kaga* returned to the yards for a major reconstruction. This work actually occurred before *Akagi's* and was even more extensive. The hull was lengthened 34ft and underwater protection increased. The two lower flight decks were removed and the main flight deck rebuilt so that it extended up to the bow for a total of 815ft. As with *Akagi*, a third elevator and a small island were added and the former stack system was reduced to a single downward-facing stack. Aircraft capacity was increased to 72 plus 18 reserves. *Kaga* returned to service in mid-1935 and retained this configuration until its loss.

Armament. *Kaga's* original armament was similar to that of *Akagi* but was significantly upgraded during its 1934–35 modernization. The carrier

Akagi under attack by US B-17 bombers on June 4, 1942. Note the large Rising Sun placed on the forward part of the flight deck for the Midway operation. (US Naval Historical Center)





Kaga in 1936 after modernization. (US Naval Historical Center)

retained its ten 8in guns, but all were mounted in casemates only 15ft above the waterline, drastically reducing their effectiveness (assuming an 8in gun on a carrier had any utility at all, clearly not the case by 1941). Anti-aircraft protection surpassed that of *Akagi* and included eight Type 89 dual mounts. A total of 30 25mm AA guns were also fitted in twin mounts. *Kaga* did not carry radar.

Operational History. Together with *Akagi*, *Kaga* formed the Imperial Navy's Carrier Division 1, the elite unit of the First Air Fleet. *Kaga*'s wartime exploits were similar to *Akagi*'s except that *Kaga* missed the expedition into the Indian Ocean in April 1942 because of a grounding incident in February 1942. Repaired on time for the Midway operation, *Kaga* was struck by four bombs from American dive-bombers from USS *Enterprise* on June 4, 1942. The resulting fires could not be brought under control and she sank the same day.

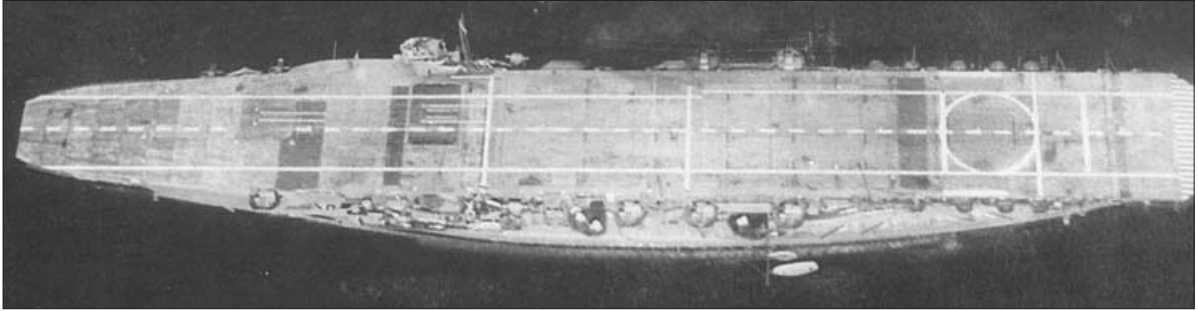
HIJMS KAGA (AFTER 1935 RECONSTRUCTION)

Displacement:	38,200 tons
Dimensions:	Length 855ft
	Beam 103ft
	Draft 29ft
Maximum speed:	28kts
Radius:	10,000nm
Crew:	2,019

Ryujo (Heavenly Dragon)

Design and Construction. After the construction of *Akagi* and *Kaga*, only 30,000 tons remained for additional carriers under the Washington Treaty. With this remaining tonnage, the Imperial Navy wanted as many ships as possible, each with a useful number of aircraft and the speed to operate with the fleet. Under the Washington Treaty, carriers under 10,000 tons were exempted from calculations. *Ryujo* was designed to make use of this exemption. Originally it was to be an 8,000-ton ship carrying 24 aircraft in a single hangar. However, before construction was begun, it was determined that such a small air group would not be effective, so a second hangar deck was added which brought aircraft capacity up to 48. The resulting design resulted in a ship of some 12,500 tons, well over treaty restrictions.

Service Modifications. After a year in service, *Ryujo* was returned to the yards in August 1934 to address stability problems. These were largely corrected by the addition of larger bulges, more ballast, and the removal of two of the six Type 89 mounts. After re-entering service, additional



Kaga pictured before the start of the war. The small size of the island is evident, as is the battleship hull form. (*Ships of the World*)

problems were found, again related to the ship's stability. *Ryujo* again entered the yard in May 1936 to have an additional deck built on her forecastle to prevent shipping water in heavy seas.

Armament. *Ryujo* entered service with a heavy armament including six Type 89 mounts and 24 12.7mm machine guns. Two of the Type 89s were removed in *Ryujo*'s first refit. By the outbreak of the Pacific War, the machine guns had been replaced with 22 25mm guns in a mix of double and triple mounts. No radar was fitted before the ship was lost.

Operational History. Despite its limitations, *Ryujo* was employed extensively during the initial period of the Pacific War, mostly on secondary operations. *Ryujo*'s aircraft covered the landings in the Philippines in December 1941 and later the invasion of Java in February 1942. The ship was also part of the Imperial Navy's Indian Ocean raid in April 1942. She was also present at the battle of Midway, but was assigned to the Aleutians diversionary attack, thus avoiding the disastrous defeat inflicted on the Imperial Navy's main carrier force. Committed to counter the American seizure of Guadalcanal in August 1942, *Ryujo* was subjected to attack by aircraft from USS *Saratoga* during the battle of the Eastern Solomons and was quickly destroyed by four bombs and one torpedo.

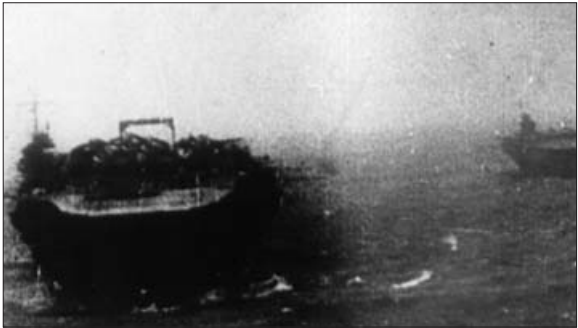
Kaga en route to Pearl Harbor in December 1941. For the Hawaiian operation, *Kaga* carried 18 A6M fighters, 27 D3A dive-bombers and 27 B5N attack aircraft. (US Naval Historical Center)

HIJMS RYUJO (AFTER 1936 REFIT)

Displacement:	10,600 tons
Dimensions:	Length 590ft
	Beam 68ft
	Draft 23ft
Maximum speed:	29kts
Radius:	10,000nm
Crew:	924

Soryu class (Soryu - Deep Blue Dragon, and Hiryu - Flying Dragon)

Design and Construction. *Soryu* has the distinction of being the first Japanese fleet carrier designed as such from the keel up. She epitomized Japanese carrier design philosophy with a relatively large aircraft capacity on a fast, light hull. With some modification, *Soryu* served as a template for the remainder of the Imperial Navy's fleet carrier designs. Laid down in 1934, the ship was completed in 1937. Two hangars were provided,





Ryujō pictured on its full speed trials in April 1933. The low freeboard in the forecastle area is evident, as is the potential for instability. (*Ships of the World*)

giving the *Soryu* the capacity to operate 63 aircraft with another eight in reserve. Three aircraft elevators were carried. Exhaust gases were vented through two downward-venting stacks on the starboard side, and a small island was built well forward on the starboard side. Powerful machinery and a cruiser-type hull, combined with a high beam-to-waterline ratio, gave a very high speed, but protection over machinery and magazine spaces was entirely inadequate.

Hiryu was a near sister of *Soryu* and was laid down in 1936 to an improved design. With an extra 1,400 tons in displacement, some important improvements were made. The hull was strengthened and the beam increased for added stability. Additional armor was also fitted, rectifying one of the design defects on *Soryu*, but it was still inadequate against attack by aircraft bombs. The single biggest difference between the two ships was the portside island mounted amidships on *Hiryu*. Like the portside island on *Akagi*, it proved a failure in service because of the generation of dangerous wind currents aft of the island and the fact that the placement of the island adversely affected aircraft recovery and parking space. This experiment was never repeated after the completion of *Hiryu*. A total of 57 aircraft were carried with another 16 in reserve.

Service Modifications. Both ships proved very satisfactory in service and neither saw any significant modification during their relatively short service lives.

Armament. The weapons fit on both ships was similar. Both carried six Type 89 mounts, three on each side just below the flight deck. Short-range anti-aircraft protection was provided by a mix of double and triple 25mm mounts. *Soryu* carried 14 double mounts while *Hiryu* carried a mix of seven triple mounts and five twin mounts. Of note, *Hiryu*'s one Type 89 mount and three 25mm mounts aft of the stacks on the starboard side were provided with full shields, another design feature repeated on carriers with downward-venting stacks. No armament was added before their loss and neither ship carried radar.



Ryujō under way in September 1938 after its second major refit to correct stability problems. Though designed to carry 48 aircraft, in service many fewer were embarked. At the battle of the Eastern Solomons, only 24 A6Ms and nine B5Ns were carried. The ship's small flight deck, small elevators, and unfavorable elevator placement made aircraft operations difficult and greatly reduced the ship's effectiveness. (US Naval Historical Center)



Soryu projecting an image of speed and power during sea trials in January 1938. **Soryu's** air unit included 18 A6M fighters, 18 D3A dive-bombers, and 18 B5N attack aircraft. (*Ships of the World*)

Operational History. The two ships formed the First Air Fleet's Carrier Division 2 and saw extensive service before their loss early in the war. Both participated in the Pearl Harbor operation and then were detached to support the invasion of Wake Island in December 1941. Operating with the rest of the First Air Fleet, both supported the invasion of the Dutch East Indies and participated in the devastating attack on Port Darwin, Australia. In April 1942, Carrier Division 2 took part in the Japanese raid into the Indian Ocean, striking Colombo and Trincomalee in Ceylon. Both ships met their end in the battle of Midway. *Soryu* was caught by US Navy dive-bombers on the morning of June 4 and was hit by three bombs from USS *Yorktown* aircraft. The ship was soon ablaze as the fire spread from fueled and armed aircraft and after only 20 minutes following the attack the ship was abandoned. She sank the same day with a heavy loss of life. *Hiryu* escaped the initial attack and immediately retaliated against the American carriers with torpedo and dive-bomber strikes. These eventually resulted in the loss of *Yorktown*. Later on June 4, *Hiryu* was attacked by dive-bombers from USS *Enterprise*, resulting in four hits. Although initially able to maintain power and fight the resulting fires, the ship could not be saved and she sank the next day.

HIJMS SORYU

Displacement:	15,900 tons (<i>Hiryu</i> 17,300 tons)
Dimensions:	Length 746ft Beam 70ft (<i>Hiryu</i> 73ft) Draft 25ft
Maximum speed:	34kts
Radius:	7,680nm (<i>Hiryu</i> 7,670nm)
Crew:	1,101

Shokaku class (Shokaku – Flying Crane, and Zuikaku – Lucky Crane)

Design and Construction. With the expiration of the Washington Naval Treaty in December 1936, the Imperial Navy was free to design its first fleet carrier without restriction. The Japanese desire for a ship with a high aircraft capacity, high speed, a superior radius of action and good protection was realized in the *Shokaku* class which was laid down in 1937 and entered service just in time to be included in the Pearl Harbor operation. The success of the design was evidenced throughout an eventful wartime career, and the class can be easily considered the most successful Japanese carrier design. The *Shokaku* class was superior to all its foreign contemporaries and was not surpassed until the introduction of the US Navy's *Essex* class in 1943.

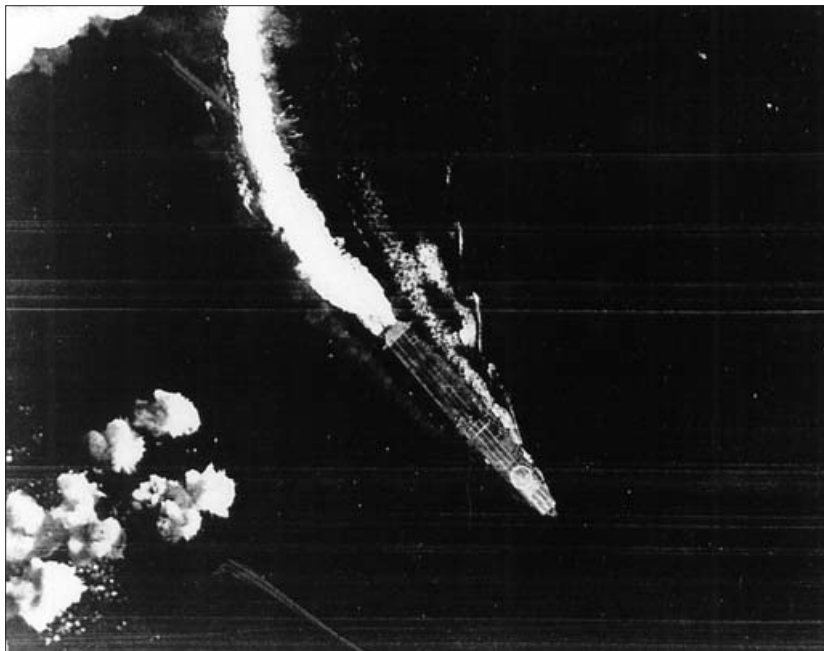


***Hiryu* on trials in April 1939. The ship carried an identical air unit to *Soryu*: 54 aircraft in three equal squadrons. (US Naval Historical Center)**

The class was essentially an upgraded *Hiryu*, being almost 100ft longer and approximately 8,500 tons heavier. In spite of this increased size, the ships retained a very high speed. This was due to the fitting of the most powerful machinery ever on an Imperial Navy ship and a new bulbous bow that reduced underwater drag.

As with the *Soryu* class, two hangars were provided, which gave an aircraft capacity of 72 with room for another 12 spare aircraft. Unlike on earlier carriers, these reserve aircraft were not stored in a state of disassembly and could be readied for operation in a short time. Three elevators were installed. A small island was placed forward on the starboard side.

Service Modifications. During their very eventful service lives, neither ship received a major refit. After *Shokaku* was lost at the battle of the Philippine Sea, due to an aviation fuel fire, *Zuikaku* had the capacity of its fuel tanks reduced and concrete blisters fitted for added protection. Both received Type 21 radar that was mounted on the island; in fact *Shokaku* was the first carrier to receive this equipment. On *Shokaku*, a smaller antenna was used which allowed the radar to be placed on top of the Type 94 fire-control director; on *Zuikaku*, the island director was



***Hiryu* under attack at the battle of Midway. During the battle, *Hiryu*'s air unit launched two strikes on US carriers and suffered heavy losses. Losses to the aircrew of the other three carriers' air units were not heavy, despite popular belief. (US Naval Historical Center)**

Hiryu taken by an aircraft from *Hosho* on June 5, 1942 after the ship had been abandoned. The bomb hits forward have thrown part of the forward elevator against the port-side island. Fires are still burning in the aft part of the ship. (*Ships of the World*)



removed and a Type 21 mounted in its place. In 1944, *Zuikaku* received a second Type 21, placed on the portside aft area of the flight deck. Both ships also received a Type 13 radar mounted on the mainmast.

Armament. The *Shokaku* class carried a heavy anti-aircraft suite. A total of eight Type 89 mounts and four Type 94 fire-control systems were fitted. The short-range anti-aircraft fit was continually increased throughout the war. When commissioned, each ship carried 12 25mm triple mounts. In June 1942, another four triple mounts were added, two forward and two aft. By July 1943, another two triple mounts were added with another 16 single mounts for a total of 70 guns. *Zuikaku* received additional protection after the battle of the Philippine Sea; 26 more single mounts were added for a total of 96. Of these, ten were portable mounts positioned on the flight deck during periods of no flight operations. Before *Zuikaku*'s final action, she received six 28-barrel 4.7in rocket launchers for short-range anti-aircraft defense. These weapons were designed to deter dive-bomber attack as they had a vertical range of only 3,300ft. In service, they proved of questionable value.

Operational History. *Zuikaku* joined *Shokaku* in October 1941 to form Carrier Division 5 of the First Air Fleet. Together, both would participate in every carrier action of the Pacific War, except Midway. Both were present during the Pearl Harbor attack and then in raids on Allied forces in New Guinea and Rabaul. Having missed the First Air Fleet's attack against Port Darwin and the East Indies, their next operation was the April 1942 Indian Ocean raid. The two ships were next assigned to cover the Japanese invasion of Port Moresby in New Guinea. This resulted in the first carrier action in history in May 1942 in the Coral Sea, where the two sisters acquitted themselves well. Aircraft from the Japanese carriers sank the carrier USS *Lexington* and damaged USS *Yorktown*. In exchange, *Shokaku* was hit by three bombs, and at the conclusion of the battle only 39 aircraft remained from both carriers. With *Shokaku* under repair and *Zuikaku*'s air group unfit for action, the Imperial Navy's two most modern carriers missed the fateful battle of Midway.

Following the fiasco at Midway, the Imperial Navy's attention turned to the South Pacific, where the Americans had landed at Guadalcanal in the Solomon Islands. In the first major attempt by the Japanese to



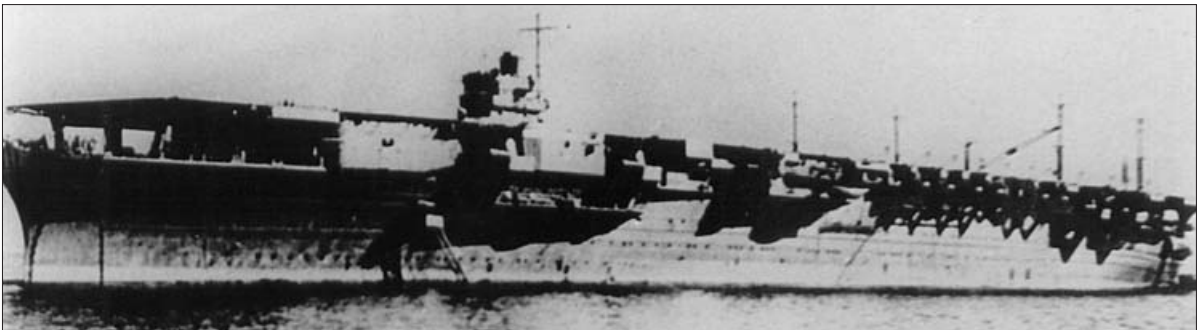
***Shokaku* after completion in August 1941. When commissioned, the ship had an air group of 18 A6M fighters, 27 D3A dive-bombers, and 27 B5N attack aircraft. (US Naval Historical Center)**

reinforce the island, the two sisters again engaged US carriers on August 24, 1942 in an inconclusive clash. *Shokaku* was hit again, suffering light damage from bomb fragments. In return, three bombs damaged *Enterprise*. Not until October would there be another carrier battle. This time the result was more favorable to the Japanese, but was not the decisive victory they were seeking. Again, *Shokaku* took the brunt of the damage, taking six bomb hits, nearly sinking her. In exchange, the Japanese sank carrier USS *Hornet* and damaged *Enterprise*. Repairs to the heavily damaged *Shokaku* prevented the ship from returning to service until March 1943.

During 1943 and the first half of 1944, the Imperial Navy husbanded its carrier force in preparation for a decisive battle. This came in June 1944 when the Americans landed on Saipan in the Marianas, inside Japan's inner defense zone. The Imperial Navy reacted with the sortie of a nine-carrier force, led by *Shokaku* and *Zuikaku*. The resulting clash, the battle of the Philippine Sea, was the largest carrier battle in history. The battle did not turn out as the Japanese had planned; in fact, their decisive defeat resulted in the virtual end of the Imperial Navy's carrier force. A series of Japanese carrier air strikes on June 19 were shattered by strong American defenses. On the same day, *Shokaku* was hit by four torpedoes from the submarine USS *Cavalla*, all in the forward area of the ship. After hours of flooding, the bow was submerged to the point where the sea washed over the flight deck. As the crew gathered on the aft portion of the flight deck to prepare to abandon ship, the water reached the forward elevator well and poured into the hangars. The ship quickly upended and plunged into the depths with a loss of 1,272 crewmen. The next day, the Japanese carrier force was subjected to carrier air attack, and *Zuikaku* was moderately damaged by one bomb that penetrated the flight deck and started a fire in the hangar.

When *Zuikaku* returned to service in August 1944, the Imperial Navy's carrier fleet was a hollow force with few experienced aircrew. In

***Zuikaku* after completion in September 1941. After Midway, the composition of the ship's air unit was altered. The number of fighters was increased to 27 and the number of attack aircraft was reduced to 18. (US Naval Historical Center)**





***Shokaku* under attack during the battle of the Coral Sea. During this engagement, *Shokaku* was severely damaged by three bomb hits. En route to Japan at high speed and with a damaged bow, the ship took on so much water that it nearly capsized. (US Naval Historical Center)**

its final action during the battle of Leyte Gulf, *Zuikaku* was deployed as part of a decoy force intended to draw the attention of the US carrier fleet while the Imperial Navy's remaining surface forces struck the American landing on the island of Leyte in the Philippines. On October 25, *Zuikaku* fulfilled her final mission, being attacked and sunk by air attack after receiving seven torpedo and nine bomb hits.

HIJMS SHOKAKU

Displacement:	26,675 tons
Dimensions:	Length 845ft
	Beam 85ft
	Draft 29ft
Maximum speed:	34kts
Radius:	9,700nm
Crew:	1,800

THE LIGHT CARRIER CONVERSIONS

***Shoho* class (*Shoho* - Happy Phoenix, and *Zuiho* - Lucky Phoenix)**

Design and Construction. During the 1930s, the Imperial Navy created a shadow fleet of merchant ships and auxiliaries designed to be easily converted into carriers during war. This was another guise to avoid treaty restrictions and was an attempt to alleviate the problem of inadequate shipyard space should war come. The first result of the program was a class of two ships laid down in 1934–35 originally as high-speed oilers. Both were to have their hulls strengthened to facilitate conversion to light carriers. Plans were changed and the ships were built as submarine tenders. The first joined the fleet as such in 1939, but the second was never completed as a submarine tender. With war clouds looming, conversion of the second ship into a carrier commenced in January 1940.

When completed, *Zuiho* became a template for other auxiliary-to-carrier conversions to follow. The original diesels were removed and replaced by destroyer turbines. No armor was fitted. The flight deck was fitted over the existing structure and two elevators served a single hangar deck that could hold 30 aircraft. No island was fitted, navigation being accomplished from a position forward of the hangar. Conversion of the second ship, *Shoho*, took only a year and was completed in January 1942.

Service Modifications. *Shoho* received no modifications during its short service life.

Modifications to *Zuiho*, in addition to weapons upgrades, included the addition of a Type 21 and a Type 13 radar. In 1943, the flight deck was extended forward from 590ft to 631ft.

Armament. A total of four Type 89 mounts were carried, two on each side with their own Type 94 fire-control system. The short-range anti-aircraft fit originally consisted of an inadequate four triple 25mm mounts. *Shoho's* weapons fit was not modified before its loss. During 1943, *Zuiho* received an additional six triple mounts and four double mounts. In July 1944, *Zuiho's* anti-aircraft guns were increased to 68 with the addition of numerous 25mm single mounts. Also shipped were six 28-barrel 4.7in rocket launchers.

Operational History. *Shoho* had a very short service life and was the first Imperial Navy carrier sunk during the war. Commissioned in January 1942, her first combat action was to escort the invasion fleet during the Port Moresby operation in May. In the opening stages of the battle of the Coral Sea, *Shoho* was struck by a reported seven torpedoes and 13 bomb hits by aircraft from USS *Lexington* and USS *Yorktown*. Only 203 crewmen survived.

Zuiho participated in a number of actions and survived well into 1944. The ship took part in the Midway operation. Her next operation was with three other Imperial Navy carriers in the battle of Santa Cruz in October 1942. In this engagement, *Zuiho* suffered light damage when she was hit by two bombs. *Zuiho's* next action was at the battle of the Philippine Sea where her air group was almost annihilated but the ship was undamaged. Assigned to accompany *Zuikaku* as part of the diversionary force at Leyte Gulf, she was subjected to extensive air attack and suffered two torpedo hits, several bomb hits, and innumerable near misses. Progressive flooding resulted in her loss on October 25 with a relatively small loss of life.



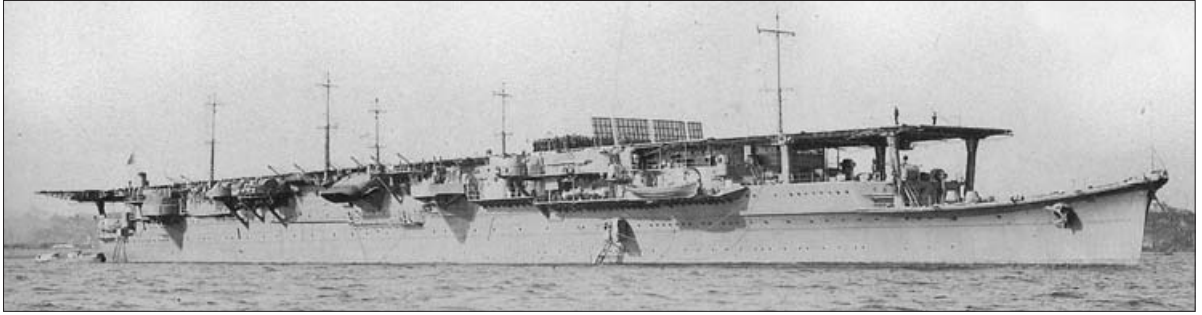
***Zuikaku's* crew gathers on the listing flight deck to salute the naval ensign as it is lowered. With its loss in October 1944, *Zuikaku* was the last of the six Pearl Harbor carriers to be sunk. (US Naval Historical Center)**

HIJMS SHOHO

Displacement:	11,262 tons
Dimensions:	Length 712ft
	Beam 59ft
	Draft 22ft
Maximum speed:	28kts
Radius:	9,236nm
Crew:	785

***Hiyo* class (*Hiyo* – Flying Falcon, and *Junyo* – Peregrine Falcon)**

Design and Construction. In addition to several auxiliary ships that were designed to be quickly converted into carriers, the Imperial Navy also subsidized the building of passenger liners that could be converted into carriers. The largest of these merchant conversions became the *Hiyo* class. The *Kashiwara Maru* and *Izumo Maru*, the largest passenger liners in the Japanese merchant fleet, were laid down in 1939. However, in response to growing American naval appropriations beginning in 1938 and a desire to maintain carrier parity with US, the



Shoho in December 1941 before its conversion was complete. Part of the ship's company can be seen mustered on the flight deck aft of the wind screen. Note the downward-facing stack. Just forward of the stack is a Type 89 anti-aircraft mount and a Type 94 fire-control director. (*Ships of the World*)

Shoho under attack in the Coral Sea. She was designed to carry 30 aircraft – 21 fighters and six attack aircraft with another three attack aircraft in reserve. When lost, only 18 aircraft were embarked – 12 fighters and six attack aircraft. Even by May 1942, the Imperial Navy's chronic shortage of carrier aircraft and aircrew was evident. (US Naval Historical Center)

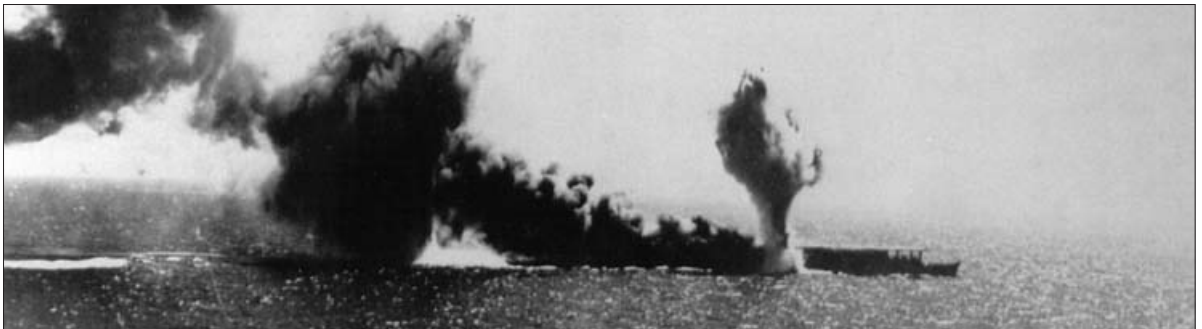
two liners were requisitioned in February 1941 and work began on their conversion into carriers.

The *Hiyo* class represented a different direction for Japanese carrier design. The largest island to date was provided, and for the first time the stack was combined with the island. The stack was sloped outward at 26 degrees to keep exhaust away from the flight deck. During conversion, a minimum of protection was provided so as not to reduce the already borderline 25.5 knots top speed. Only some two inches of steel was provided around the machinery spaces and one inch around the magazines. Some additional watertight subdivision was incorporated.

In an attempt to increase speed, a hybrid propulsion system was provided with destroyer-type boilers being mated to merchant turbines. The result was machinery that proved troublesome and provided a marginal speed for fleet use. Two elevators were installed to service two hangars. Aircraft capacity was rated at 48 with another five in reserve.

Service Modifications. *Junyo* received a Type 21 radar in July 1942 mounted on the island; similar work followed on *Hiyo* in the autumn of 1942. Both ships received a second Type 21 in 1943 and a Type 13 in 1944. In June 1944, following the loss of *Hiyo* to an aviation fuel explosion, *Junyo* had the spaces around its fuel tanks filled with concrete.

Armament. Six Type 89 mounts were positioned three per side. When commissioned, eight triple 25mm mounts were also carried. In early 1943, *Hiyo* received an additional four triple 25mm mounts. *Junyo* received the same increase during the summer of 1943. Before the battle of the Philippine Sea, both ships received an additional four triple 25mm mounts and 12 single mounts. After the battle, *Junyo's* anti-aircraft armament was increased by an additional three triple, two double, and 18 single 25mm mounts for a total of 79 25mm guns. *Junyo* also received the standard Japanese carrier late-war addition of six 28-barrel 4.7in rocket launchers



mounted three per side along the forward part of the flight deck.

Operational History. *Junyo* was commissioned in May 1942 and *Hiyo* in July 1942. *Junyo* quickly saw its first action as part of the Northern Force assigned to occupy two islands in the Aleutians as part of the Midway operation. Her next action was at the battle of Santa Cruz, where her air group helped sink USS *Hornet* while suffering no damage in return. *Junyo* remained active in the South Pacific throughout July 1943. Off the Japanese coast in November 1943, a US submarine hit the carrier with two torpedoes but *Junyo* was towed to port. In the battle of the Philippine Sea, *Junyo* was bombed on June 20, taking two hits around the island. After repairs, she conducted two transport missions to the Philippines area. While returning to Japan after the second, she was hit by three submarine torpedoes. Despite heavy flooding, the ship made it back to Japan but was never fully repaired. *Junyo* was surrendered and scrapped after the war.

Hiyo was active in the South Pacific early in its career but missed the battle of Santa Cruz because of engine problems. In June 1943, she was torpedoed by a submarine off the Japanese coast but survived. During the battle of the Philippine Sea, she was hit by two aircraft torpedoes. Probable leaking fuel vapor caused massive internal explosions, resulting in the loss of the ship.



A well-known shot of *Zuikaku* under attack during the battle of Leyte Gulf. Note the flight-deck camouflage; though dramatic it was ineffective. A Type 13 radar can be seen on the lowered mast on the port side. Also note the buckled flight deck aft, the result of a bomb explosion on the hangar deck. (US Naval Historical Center)

HIJMS HIYO

Displacement:	24,140 tons
Dimensions:	Length 718ft
	Beam 88ft
	Draft 27ft
Maximum speed:	26kts
Radius:	10,000nm
Crew:	1,224

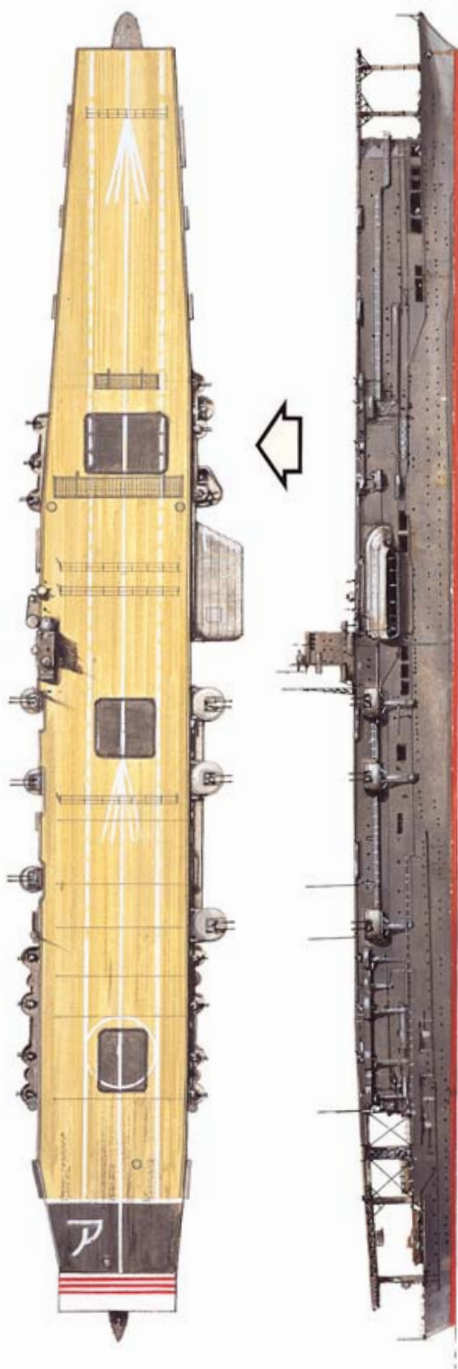
Ryūhō (Dragon Phoenix)

Design and Construction. Another member of the Imperial Navy's shadow carrier fleet, *Ryūhō* was the least successful of the five light carriers converted from auxiliary ships. She originally entered service as a submarine tender in 1934. Conversion to a light carrier began in December 1941 and was completed in November 1942. Of note, while undergoing conversion in Yokosuka, she was lightly damaged by aircraft from the Doolittle Raid in April 1942.

When completed, the ship presented the same flush-deck appearance as the *Shōhō* class. The customary two elevators were fitted, but aircraft capacity was only 24, with another seven in reserve. The original diesels were removed and replaced by destroyer turbines during conversion, but top speed was a relatively slow 26 knots. With its small flight deck, insufficient speed, light construction, and small air group, *Ryūhō* was considered a second-line unit.

A: Pre-war Imperial Navy carriers

1: Akagi



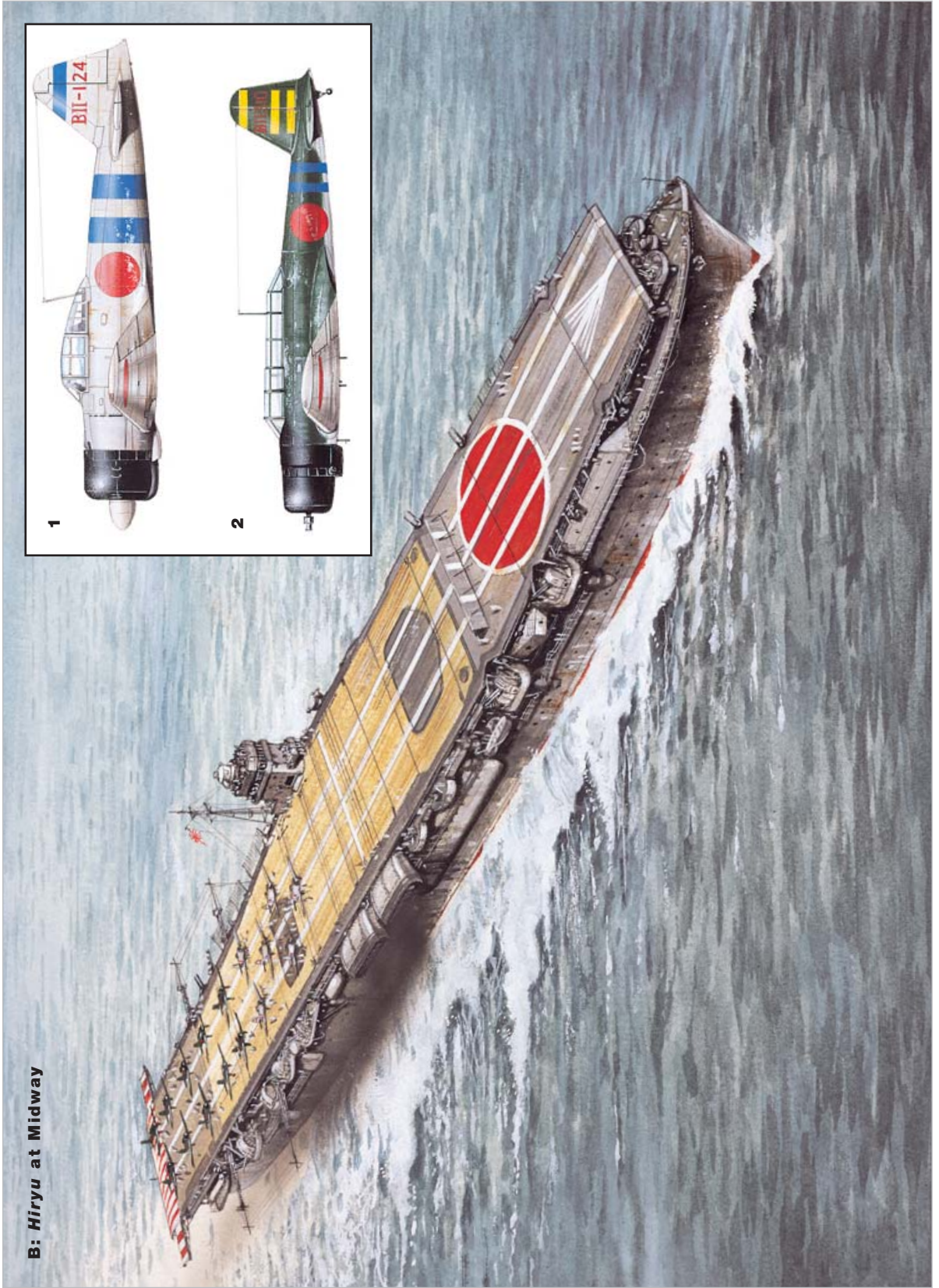
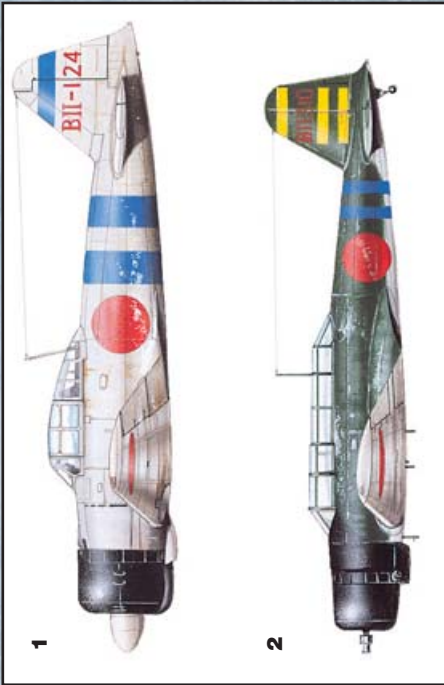
2: Kaga



3: Soryu

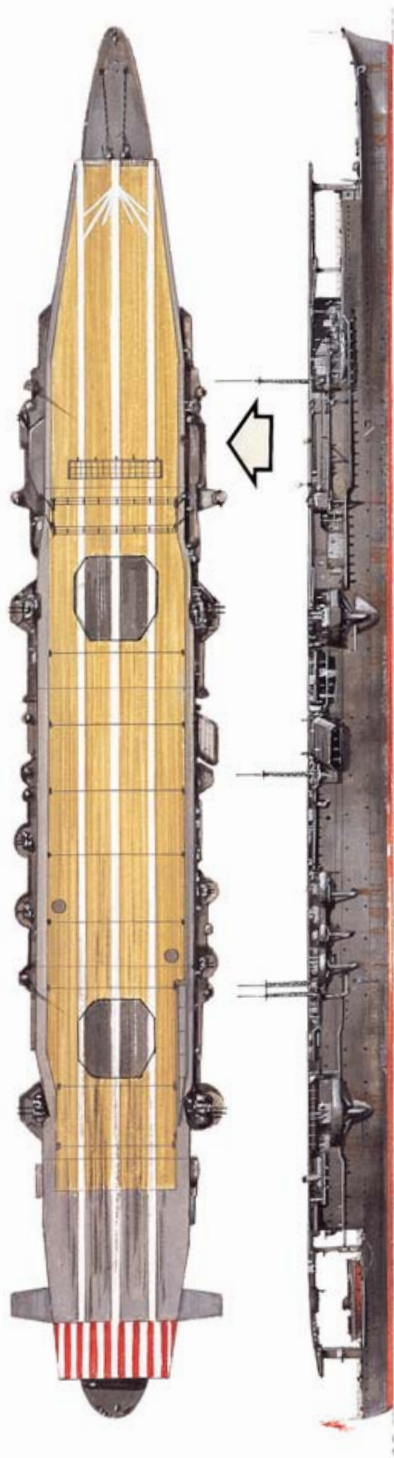


B: Hiryu at Midway

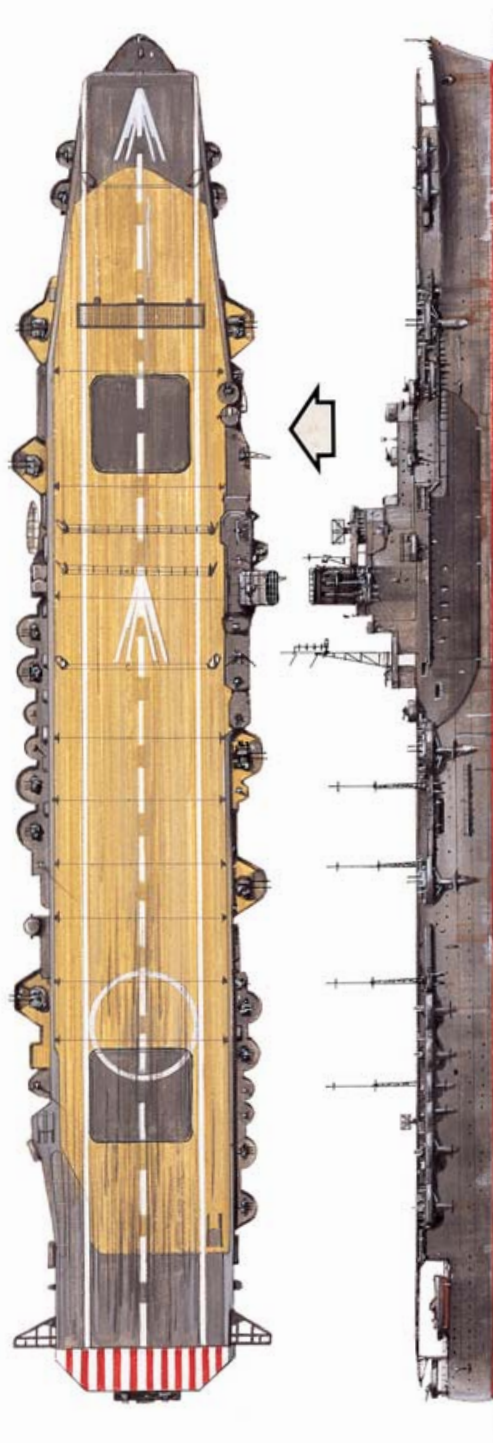


C: Imperial Navy carrier conversions

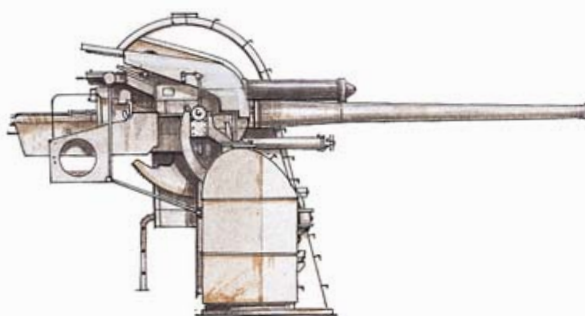
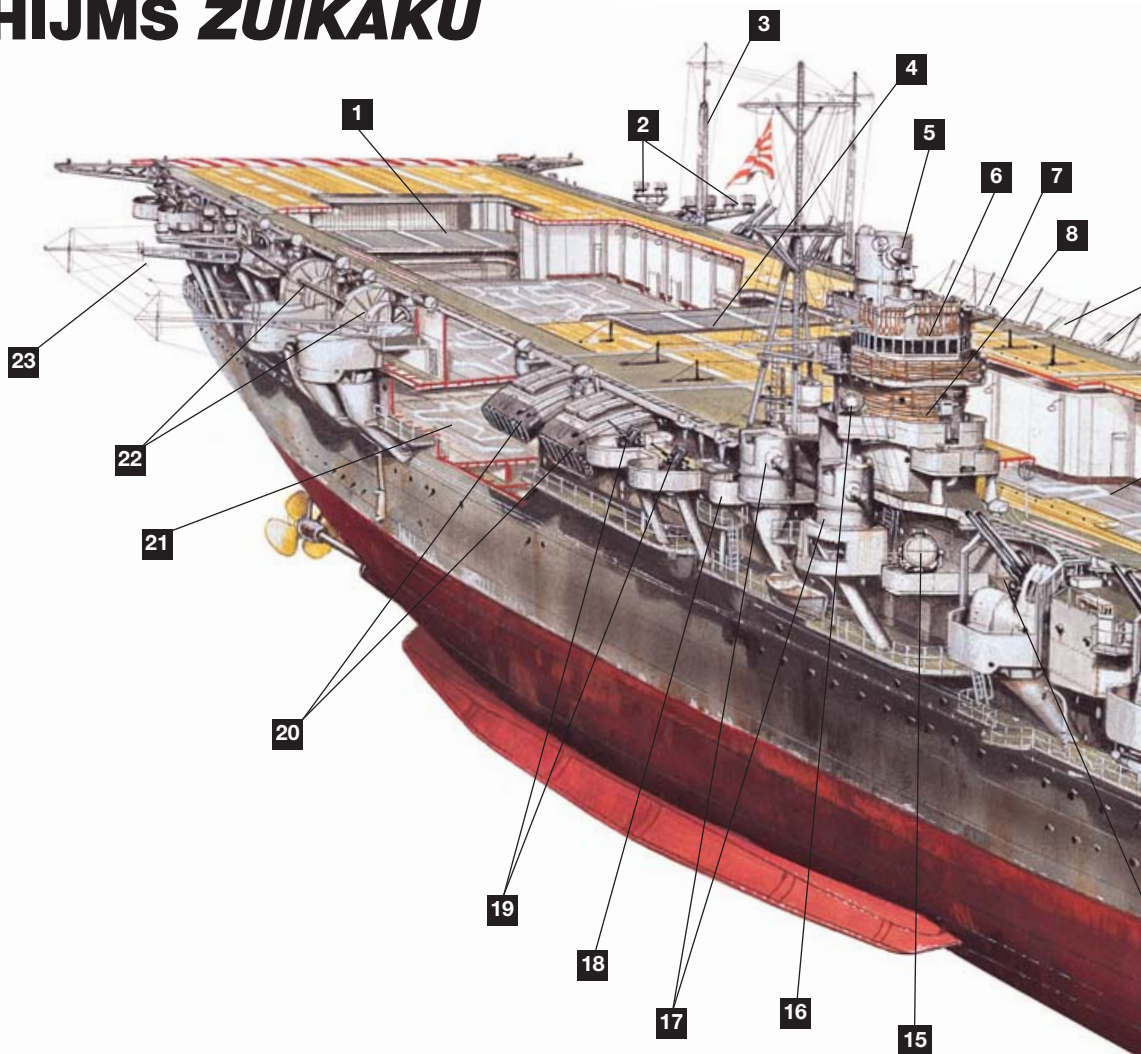
1: *Shoho*



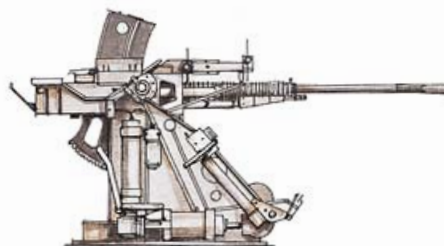
2: *Hiyo*



D: HIJMS *ZUIKAKU*



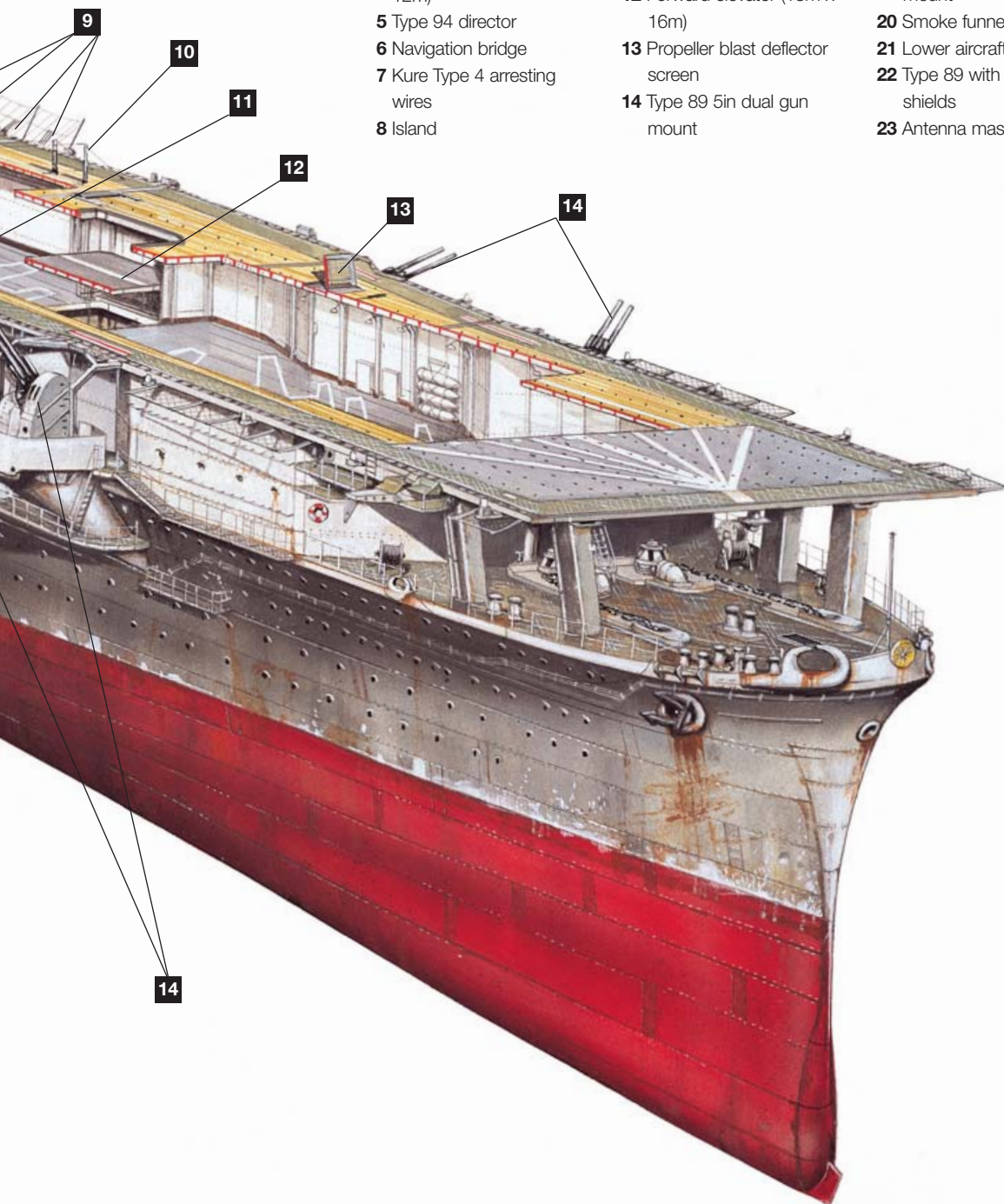
1: Type 89 5in anti-aircraft gun



2: Type 96 25mm anti-aircraft gun (triple mount)

KEY

- | | | |
|--------------------------------------|--|---|
| 1 Rear elevator (13m x 12m) | 9 Type 96 25mm triple gun mount | 15 110cm searchlight |
| 2 Landing guide light (green) | 10 Kusho Type 3 crash barrier | 16 60cm signal light |
| 3 Antenna mast | 11 Upper aircraft hangar | 17 Type 94 director |
| 4 No. 2 elevator (13m x 12m) | 12 Forward elevator (13m x 16m) | 18 Type 95 director |
| 5 Type 94 director | 13 Propeller blast deflector screen | 19 Type 96 25mm triple gun mount |
| 6 Navigation bridge | 14 Type 89 5in dual gun mount | 20 Smoke funnels |
| 7 Kure Type 4 arresting wires | | 21 Lower aircraft hangar |
| 8 Island | | 22 Type 89 with smoke shields |
| | | 23 Antenna mast |

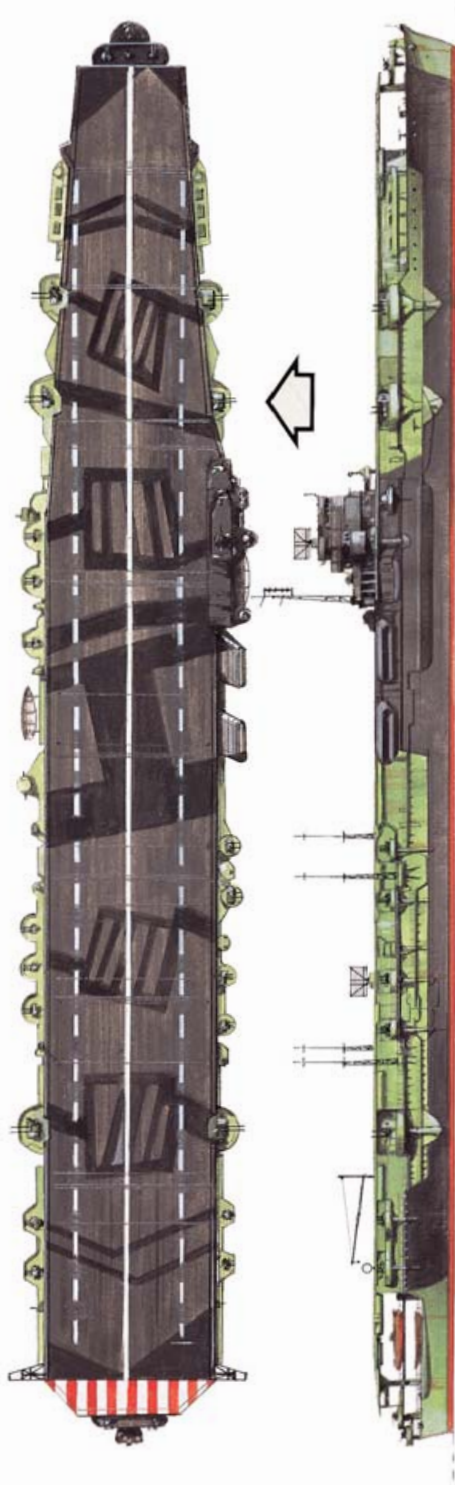


E: Wartime carrier construction

1: *Taiho*



2: *Amagi*



3: *Shinano*

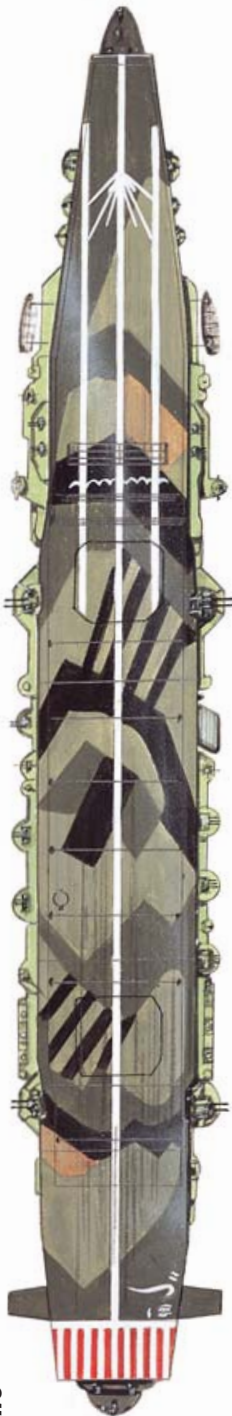


F: *Taiho* at the battle of the Philippine Sea

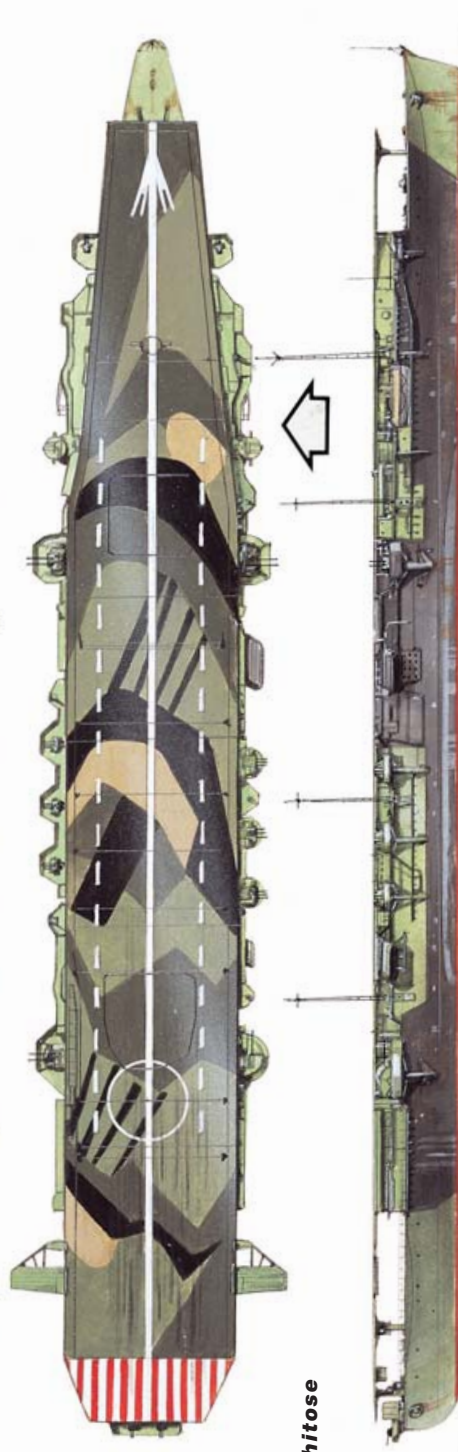


G: Imperial Navy carrier camouflage

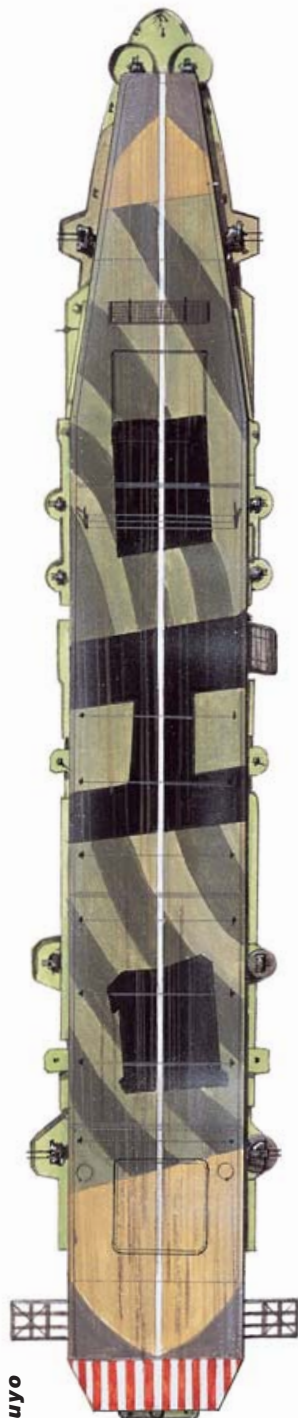
1: Zuiho



2: Chitose



3: Chuyo





Junyo shown after the war. The two ships of the *Hiyo* class were the most elaborate merchant conversions completed during the war. Initially, a typical air unit for these ships was 12 A6M fighters, 18 D3A dive-bombers, and 18 B5N attack aircraft. By 1944, this was modified to 27 fighters (nine of which were fighter-bombers), 18 dive-bombers, and six attack planes. (US Naval Historical Center)

Close-up of *Junyo*'s island showing the slanted stack. Also note the wood-planked flight deck. (US Naval Historical Center)



Service Modifications. In 1943, the flight deck was extended forward from 607 to 660ft to allow the use of heavier aircraft. In 1944, a Type 21 radar was fitted.

Armament. The standard four light-carrier Type 89 mounts were carried, two on each side with their own Type 94 fire-control system. The number of 25mm guns was increased in 1943 to 42 and again in 1944 to 61. The final configuration was ten triple, four twin, and 23 single mounts.

Operational History. *Ryūhō*'s career confirmed the low opinion held of her by the Japanese. The ship was torpedoed off Tokyo Bay in December 1942 but survived. For most of her life she was used as an aircraft ferry or training carrier. *Ryūhō*'s only combat action was during the battle of the Philippine Sea in which the ship suffered light damage from bomb near misses. *Ryūhō* did conduct the last voyage of an Imperial Navy carrier beyond home waters when she transported 58 *Ohka* suicide rocket bombs to Formosa in December 1944–January 1945. In March 1945 the ship was attacked and severely damaged by US carrier aircraft in Kure. The ship was put into dry dock to repair flooding, but was never fully repaired. *Ryūhō* survived the war to be scrapped in 1946–47.

HIJMS RYUHO

Displacement:	13,360 tons
Dimensions:	Length 707ft
	Beam 64ft
	Draft 22ft
Maximum speed:	26kts
Radius:	8,000nm
Crew:	989

***Chitose* class (*Chitose* – a city in Hokkaido, and *Chiyoda* – a city near Tokyo)**

Design and Construction. The two ships of the *Chitose* class were the final two auxiliaries to be converted to light carriers. Both were built originally as high-speed seaplane carriers and saw service early in the Pacific War in this capacity. After Midway, with the need for carriers becoming pressing, it was decided to convert both into carriers. *Chitose*'s conversion began in January 1943 and was completed in January 1944; *Chiyoda*'s was completed in only ten months.

During conversion, large bulges were added to maintain stability. These ships were the only light carriers to have two hangars, but aircraft



Ryuho shown after the war at Kure. The ship's only combat service was at the battle of the Philippine Sea, during which it embarked an air group of 21 A6M fighters and nine attack aircraft. (US Naval Historical Center)

capacity remained the same as the *Shoho* class – 30 aircraft. In all other respects, the class was very similar to *Zuiho* in her late-war configuration. The relatively high speed of this class combined with their long radius made them suitable for employment in fleet service, working with the very similar *Zuiho*.

Service Modifications. None, except armament increases noted below.

Armament. Four Type 89 mounts were carried, two on each side in the usual light-carrier arrangement. Thirty 25mm guns were carried in ten triple mounts. In July 1944, another six triple mounts were added for a final total of 48 25mm guns.

Operational History. During March and April 1944, *Chiyoda* conducted two urgent aircraft ferry missions. Both ships were assigned to the “Van Force” during the battle of the Philippine Sea, where they were escorted by the Imperial Navy’s most powerful surface units in an attempt to draw US carrier strikes away from the main carrier force. Despite this, only *Chiyoda* was damaged during the battle, suffering a single bomb hit on June 20. Both ships were available for the last sortie of the Imperial Navy’s carrier force during the battle of Leyte Gulf. Again acting as a diversionary force, both ships were attacked by US carrier aircraft on October 25. *Chitose* was hit by what were probably three torpedoes and sank within an hour. *Chiyoda* was hit by four bombs. Escort ships were unable to rescue the crew and later on the 25th, *Chiyoda* came under fire from US surface forces. The ship sank with no survivors.

A ship of the *Chitose* class pictured in the Inland Sea in late 1943. The simplicity of the conversion from its seaplane carrier origin is evident. Designed for a capacity of 30 aircraft, these ships carried 21 A6M fighters and nine attack aircraft during the battle of the Philippine Sea. (*Ships of the World*)





Another shot of a *Chitose*-class unit showing its two port-side Type 89 mounts and four 25mm triple mounts. The ship's Type 21 radar can be seen in the raised position on the forward part of the flight deck. (*Ships of the World*)

HIJMS CHITOSE

Displacement:	11,190 tons
Dimensions:	Length 631ft
	Beam 68ft
	Draft 24ft
Maximum speed:	29kts
Radius:	11,000nm
Crew:	1,470

FLEET CARRIER WARTIME CONSTRUCTION

Taiho (Great Phoenix)

Design and Construction. Construction on the “Great Phoenix” began in 1941. This ship was the first Japanese carrier designed to receive damage and continue fighting. To achieve this, a new design feature was introduced – an armored flight deck designed to withstand 1,000lb bombs. Unlike the only other armored carriers then in service with the Royal Navy, *Taiho* had only an armored flight deck of between 75mm and 80mm – the sides of the hangar were not armored. A strong armored belt of up to 5.9in was also installed. Another unique design feature was the enclosed bow designed to improve seaworthiness. A large island similar to that on the *Hiyo* class was built, again using a slanted stack. *Taiho* could also act as a support carrier, and for this purpose she carried additional ordnance and 33 percent more than the usual supply of aviation fuel.

Taiho was designed on the basis of the *Shokaku* class. To compensate for the greater upper weight from the armored flight deck, the ship was built with one deck less than *Shokaku* to reduce its center of gravity. Only

Taiho pictured after its arrival at Tawi Tawi anchorage in May 1944. A number of A6M fighters and B6N attack aircraft can be seen on the flight deck aft. (*Ships of the World*)





Katsuragi on trials. The similarity to the *Soryu* class is obvious. (US Naval Historical Center)

two elevators were fitted, forward and aft of the armored area of the flight deck, as it was not desired to weaken the integrity of the armored flight deck. Two hangars were provided; on its only combat operation, *Taiho* embarked 75 aircraft.

Service Modifications. None.

Armament. Anti-aircraft protection was provided by a new weapon that had been introduced earlier on the Imperial Navy's new class of anti-aircraft destroyer. This was the excellent Type 98 anti-aircraft gun, a 100mm weapon with a maximum range of 21,300yds, longer than the older Type 89 5in gun. *Taiho* was the only carrier to use this weapon and had six dual mounts fitted three on each side of the flight deck. Seventeen triple 25mm guns were placed around the flight deck and on the island. Twenty additional single mounts were also fitted. Two Type 21 radars were also carried, one on the forward top of the island and one on the lower aft section of the island.

Operational History. Upon completion in March 1944, the ship moved to the Mobile Fleet's anchorage near Singapore for sea trials and aircrew training. *Taiho* was chosen as the flagship of the Mobile Fleet, and much was expected of her during the impending decisive battle. On June 15, *Taiho* sortied to execute operation "A-Go". On June 19, while launching strike aircraft against the US carrier fleet, *Taiho* was hit by one torpedo from USS *Albacore*. The resulting damage flooded the forward elevator well and resulted in a slight bow trim, but this was not judged to be serious and the ship maintained 26 knots. However, the single torpedo had cracked the aviation fuel tanks in the area of the forward elevator and caused gasoline to mix with water in the elevator well. The crew's response demonstrated the uneven standard of damage-control training in the Imperial Navy. All hangar doors and hatches were opened, increasing the spread of vapor fumes. The damage-control officer switched on all fans throughout ship, turning the ship into a floating bomb. Just over six hours after being torpedoed, a huge explosion took place that buckled the flight deck upwards and blew out the sides of the hangar. The explosion also ruptured the hull and caused a loss of power. Unable to fight the fires, the ship became a raging inferno and sank with a third of its crew.

HIJMS TAIHO

Displacement:	29,300 tons
Dimensions:	Length 855ft
	Beam 91ft
	Draft 32ft
Maximum speed:	33kts
Radius:	10,000nm
Crew:	1,751

Unryu class (Unryu – Heaven-bound Dragon Riding the Clouds, Amagi – an extinct volcano, and Katsuragi – a mountain near Osaka)

Design and Construction. With its final fleet-carrier design, the Imperial Navy returned to its pre-war concept of a fast carrier with little protection and a relatively large air group. With war looming, the Imperial Navy took steps to construct a large number of fleet carriers. In the construction programs for 1941 and 1942, six carriers were ordered. To facilitate their timely completion, the ships were patterned after *Hiryu*, not the larger and more complex *Shokaku* class or *Taiho*. The first three ships were laid down in 1942 and another three in 1943. Of these, only three, *Unryu*, *Amagi*, and *Katsuragi* were completed. Construction of the other three, *Kasagi*, *Ikoma*, and *Aso*, was suspended in 1945, with the ships only 84 percent, 60 percent, and 60 percent completed, respectively. Another 11 ships of the class were ordered but never laid down.

The basic hull was almost identical to *Hiryu* with the same distribution of armor. The biggest difference from *Hiryu* was the placement of the island forward on the starboard side. Only two elevators were fitted to service the two hangars and a total of 63 aircraft could be carried (57 plus another six in reserve). In line with battle experience, aviation fuel capacity was halved, and the space around the fuel tanks was filled with concrete. Of the three ships completed, *Unryu* and *Amagi* carried the same machinery as the *Soryu* class, providing a top speed of 34 knots. *Katsuragi* was completed with two sets of destroyer turbines, but speed was only slightly reduced at almost 33 knots.

Service Modifications. None, except for the armament increases noted below.

Armament. The weapons fit was similar to that on *Hiryu*. Six Type 89 mounts were fitted, three on each side of the flight deck. However, only a single fire-control director was provided for all six positions. Short-range anti-aircraft protection was provided by 16 triple and three single 25mm mounts on *Unryu* and *Amagi* when completed. Shortly after completion, another four triple mounts were added along with another 13 single mounts for a total of 76 guns. This was increased during the final months of the war to 22 triple and 23 single mounts for a final total of 89 guns. All



Katsuragi shown after the war in a damaged condition. Note the faded flight-deck camouflage and the buckled flight deck. (US Naval Historical Center)

three ships also received six 28-barrel 4.7in rocket launchers for short-range anti-aircraft defense. Two Type 21 radars were fitted, one on the island and a second along the aft edge of the flight deck. Two Type 13 radars were also fitted, one on the mainmast and a second on one the four hinged radio masts.

Operational History. The three completed ships of the *Unryu* class were destined never to participate in a fleet action and it is almost certain that none of the ships ever embarked a full air group. Only one saw active service transporting aircraft and high-priority cargo to the Philippines. Late in the war, the two surviving ships were laid up in Japanese ports because of fuel shortages.

Unryu was the first ship to be commissioned in August 1944. She was assigned to the Mobile Fleet, but with the shortage of trained aircrews, the ship did not accompany the Imperial Navy's carrier force on its last mission in the battle of Leyte Gulf in October 1944. In December, *Unryu* was assigned the mission of taking an emergency cargo of *Ohkas* to Manila. *Unryu* embarked a small aviation detachment and headed south. On December 19, the ship was attacked by the submarine USS *Redfish* and hit by two torpedoes. The second hit the forward aviation fuel tanks and the ship exploded and sank in seven minutes, taking with her all but 147 of the crew.

Amagi was completed only five days after *Unryu*. *Katsuragi* was commissioned into service in October. Neither ship would leave home waters because of fuel, aircraft, and aircrew shortages. *Amagi* suffered light damage in March 1945 from a US carrier aircraft on Kure. In July 1945, another raid took place on Kure. Heavily damaged on July 24, *Amagi* finally sank in Kure, following additional damage suffered in a July 28 raid. She was the last Imperial Navy carrier sunk in the Pacific War. *Katsuragi* was also damaged in the July 24 attack but survived to be used as a repatriation ship before being scrapped in 1946.



***Amagi* under attack at Kure on March 19, 1945. Beyond *Amagi* is the escort carrier *Kaiyo*. Lack of fuel, aircraft, and aircrew prevented the three completed ships of the *Unryu* class from taking any part in fleet operations. (US Naval Historical Center)**

HIJMS UNRYU

Displacement:	17,150 tons (<i>Amagi</i> 17,460 tons, <i>Katsuragi</i> 17,260 tons)
Dimensions:	Length 742ft
	Beam 72ft
	Draft 26ft
Maximum speed:	34kts (<i>Katsuragi</i> 33kts)
Radius:	8,000nm
Crew:	1,595

***Shinano* (An ancient Japanese province)**

Design and Construction. *Shinano* has the distinction of being the largest carrier built during World War II and remained the largest carrier ever built until the introduction of the US Navy's super-carriers in the late 1950s. *Shinano* was originally laid down as the third ship of the *Yamato* class of super-battleships in May 1940. After the start of the war construction on the ship slowed; by June 1942, she was only complete up to the main deck. After the battle of Midway, even the Imperial Navy could see that battleships were no longer needed, and plans were drawn up to convert *Shinano* into a carrier. Following debate within the Naval Staff on how to

employ the ship, what emerged was the concept of using *Shinano* as a support carrier. As such, it was envisioned that she would act as a forward floating fortress able to land and refuel/rearm aircraft from less protected carriers operating to the rear. In accordance with this role and because only a single hangar deck was provided during conversion, she would operate only a small air group (47 aircraft), primarily for self-protection.

The design of *Shinano* mirrored that of *Taiho* in many respects. *Shinano* featured an armored flight deck between the elevators, this time with just over three inches of armor. As on *Taiho*, only two elevators were fitted. These served a single hangar level; the hangar area was divided into two hangars, the forward one being open with shutters and the rear area being enclosed like *Taiho*. As on *Taiho*, a large island with a slanted stack was fitted.

In addition to the armored flight deck, protection for the hull was extensive. The belt armor thickness was halved from its battleship origin, but was still over eight inches. An anti-torpedo bulge was fitted and another 7.5in of armor was fitted in an armored deck over the machinery and magazine spaces. All the armor brought the trial displacement of the ship to within 2,800 tons of a *Yamato*-class battleship.

Service Modifications. None.

Armament. Eight Type 89 mounts were carried, two pairs forward on each side of the flight deck, and another two pairs aft in a similar arrangement. Each pair was provided with its own fire-control director. *Shinano* was well supplied with short-range anti-aircraft protection, having 33 triple 25mm mounts. Twelve short-range rocket launchers were also fitted, arranged in sets of three in a similar fashion to the Type 89 guns. Two Type 21 radars were carried, one forward on the island and one on the aft portion of the island, providing 360-degree coverage. Two Type 13 radars were also carried, one on the mainmast and another on the forward port side radio mast.

Operational History. *Shinano* had the shortest career of any Imperial Navy carrier. The ship was commissioned on November 18, 1944. Ten days later, she departed Yokosuka and headed south to the port of Kure to complete fitting out. The ship was not fully ready for sea, with incomplete waterproofing and missing counter-flooding and damage-control pumps. This, combined with the inexperience of its crew, spelled disaster when she was struck by four submarine torpedoes from USS *Archerfish* early on November 29. The damage was not considered to be fatal and her captain continued to steam on at 18 knots. Counter-flooding checked the initial flooding, but *Shinano*'s incomplete condition permitted the flooding to spread. All power was lost when the boiler rooms flooded and soon thereafter the unsinkable *Shinano* capsized with over 1,400 of its crew.

HIJMS SHINANO

Displacement:	62,000 tons
Dimensions:	Length 873ft
	Beam 119ft
	Draft 34ft
Maximum speed:	27kts
Radius:	10,000nm
Crew:	2,400



Taken in November 11, 1944, this is the only known photograph of *Shinano*. The ship has taken a starboard heel during a rudder test. The hull camouflage is just visible. (*Ships of the World*)

THE ESCORT CARRIERS

Another component of the Imperial Navy's shadow carrier program was the use of passenger liners for conversion into carriers. The largest of these conversions became the *Hiyo* class and were considered so successful by the Japanese that they were typed as regular, not auxiliary carriers. Before the two largest liners were laid down, another five liners were subsidized by the Imperial Navy for possible conversion into carriers. Four of these were eventually converted into escort carriers, with the fifth being lost before she could be converted. In its place, a German liner was requisitioned.

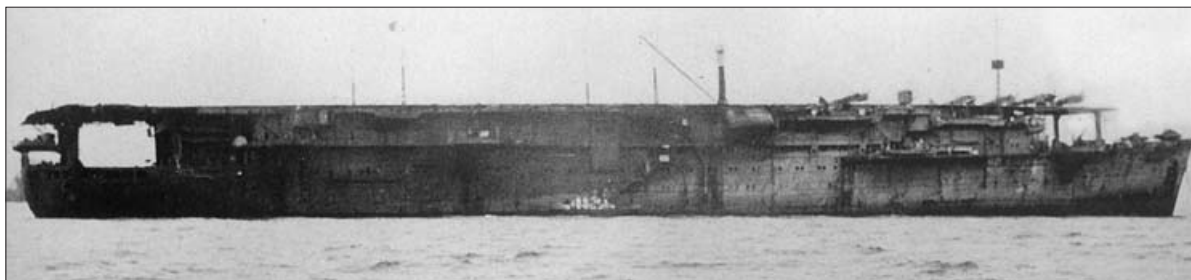
The Imperial Navy intended that these conversions would work with the Combined Fleet. Because these ships had a fairly low top speed (21–23 knots), and lacked catapults, they were never considered satisfactory for fleet work. As such, they were used primarily for aircraft ferrying operations and aircrew training. Later in the war, when the Imperial Navy realized it could no longer ignore commerce protection and created the Grand Escort Command, the remaining escort carriers were utilized in a convoy protection role.

***Taiyo* class (*Chuyo* – Heaven-bound Hawk, *Taiyo* – Great Hawk, and *Unyo* – a Hawk in the Clouds)**

Design and Construction. In 1937, the Imperial Navy subsidized the *Nitta Maru* class of three passenger liners. All were structurally designed to be converted into auxiliary carriers. The last of the three ships, *Kasuga Maru*, was actually the first completed as a carrier. In 1940, *Kasuga Maru* was requisitioned while still under construction and conversion to a carrier begun. Work was not completed until September 1941 when the ship, now named *Taiyo*, was commissioned. Conversion of the first two ships, *Nitta Maru* and *Yawata Maru*, was not completed until November and May 1942, respectively, when they emerged as *Chuyo* and *Unyo*.

The conversions were fairly austere and took only six months. When completed, the ships emerged as flush-deck carriers with the navigation bridge placed forward under the flight deck. In typical Japanese fashion, exhaust gases were vented by means of a downward-sloped stack located amidships on the starboard side. To increase speed, the original diesel engines were replaced with turbines but the result was an unsatisfactory 21 knots. Two elevators serviced a single hangar. *Taiyo* had the capacity to operate 23 aircraft (with four more in reserve) and the other two ships could carry 30 aircraft.

Service Modifications. None, except for the armament increases noted below.



Taiyo pictured with five A6M fighters on deck. The designed aircraft mix for these ships was 21 fighters and nine attack aircraft. However, when they were assigned to the Grand Escort Command, only B5Ns were carried. (*Ships of the World*)

Armament. When completed, *Taiyo* was equipped with six of the older 4.7in anti-aircraft guns in single mounts and four twin 25mm mounts. *Taiyo*'s armament was updated in 1943 with the fitting of additional 25mm guns, and in 1944 when the 4.7in guns were removed and replaced with two Type 89 mounts. By 1944, a total of 64 25mm guns were embarked.

The two sisters commissioned in 1942 were armed with the usual Type 89 mounts. *Chuyo* had 14 25mm guns when sunk in 1943; by 1944, *Unyo* had 64 25mm guns. All three ships were equipped with a Type 21 radar fitted on the forward starboard flight-deck edge.

Operational History. All three ships were sunk by submarines. *Taiyo* was the first unit commissioned in September 1941 and actually conducted two aircraft ferry runs before the start of the war. In August 1942, she worked briefly with super-battleship *Yamato* during operations near Guadalcanal; this proved to be *Taiyo*'s only frontline appearance. She was torpedoed twice by submarines between September 1942 and September 1943, but survived. In December 1943, *Taiyo* was transferred from the Combined Fleet to the Grand Escort Command and assumed her new role of convoy escort. In this capacity, *Taiyo* was struck for the final time by one torpedo from USS *Rasher* in August 1944. The ship's aviation fuel tanks exploded and the ship sank quickly with fewer than 100 survivors.

Chuyo was commissioned in November 1942 after less than six months in conversion. She conducted 13 deployments, carrying aircraft, supplies, and passengers. During the course of these missions from December 1942 until December 1943, *Chuyo* was torpedoed on three different occasions by US submarines. The third attack, by USS *Sailfish*, proved fatal. Though the ship's aviation fuel tanks did not blow up, the quick sinking of the ship resulted in the death of 1,250 crew and passengers, including 20 US prisoners being transported to Japan.

Unyo was commissioned in May 1942 and followed a similar career pattern to its two sister ships. After many ferry runs, she was assigned to the Grand Escort Command in December 1943. *Unyo* was hit by three submarine torpedoes in January 1944 but survived. Hit again by two torpedoes launched from USS *Barb* in September 1944, *Unyo* sank.

HIJMS TAIYO

Displacement:	17,830 tons
Dimensions:	Length 591ft
	Beam 74ft
	Draft 26ft
Maximum speed:	21kts
Radius:	8,500nm
Crew:	850 (Taiyo 747)

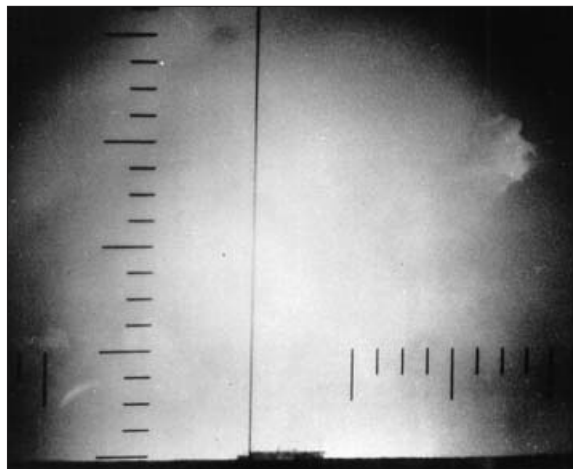
Kaiyo (Sea Hawk)

Design and Construction. *Kaiyo* was the smallest of the escort carrier conversions. In 1938, construction began on passenger liners *Argentina Maru* and *Brazil Maru*. The *Brazil Maru* was sunk before conversion could be ordered, but in December 1942 the *Argentina Maru* entered the yards to begin conversion into a carrier. Work was completed in November 1943 and was nearly identical to that of the *Chuyo* class. Again, the original diesels were replaced with turbines, but speed was still only 23 knots. Two elevators serviced a single hangar. *Kaiyo* had the capacity to operate 24 aircraft (nominally 18 fighters and six bombers).

Service Modifications. None, except for the armament increases noted below.

Armament. *Kaiyo* emerged with four Type 89 mounts. Eight triple 25mm mounts were fitted, and another 20 single mounts were added later for a total of 44 guns. Eight depth charges were also carried for anti-submarine work. A Type 21 radar was added forward on the flight-deck edge.

Operational History. *Kaiyo* joined the fleet in November 1943 and was used to ferry aircraft and escort convoys throughout 1944. In 1945, the ship became a training carrier in the Inland Sea and was used as a target for *kamikaze* pilot training. The ship suffered minor damage at Kure in March 1945. She was later sunk on July 24, 1945 by US carrier aircraft.



All three *Taiyo*-class units were sunk by submarines. Here one of these ships is captured in the periscope of USS *Haddock* in April 1943. (US Naval Historical Center)

HIJMS KAIYO

Displacement:	13,600 tons
Dimensions:	Length 546ft
	Beam 72ft
	Draft 27ft
Maximum speed:	23kts
Radius:	7,000nm
Crew:	587

Shinyo (Godly Hawk)

Design and Construction. Like all the other Imperial Navy escort carrier conversions, *Shinyo* was originally built as a passenger liner. In this case, she was the German liner *Scharnhorst*, which was serving a Pacific route when the war began and was unable to return to Germany. The Imperial Navy purchased the ship with the original intent of using her as a troop transport, but after the battle of Midway plans were begun to convert her into a carrier to train new aircrews. Conversion work began in September 1942. As the layout of the *Scharnhorst* was similar to Japanese liners of the *Nitta Maru* class, *Shinyo*'s conversion was similar to that of the *Taiyo* class with the primary differences being the addition of external bulges to increase stability and the retention of *Scharnhorst*'s original turbo-electric drive system. Two elevators were fitted to service the flush deck, single-hangar carrier, which could operate 27 aircraft with six more in reserve.

Service Modifications. None, except for the armament increases noted below.

Armament. *Shinyo* was commissioned with four Type 89 mounts. A total of ten triple 25mm mounts were originally fitted; in July 1944 additional single mounts were added to bring the final total to 50 25mm guns. A Type 21 radar was added on the forward edge of the flight deck on the starboard side.

Operational History. After joining the fleet in December 1943, *Shinyo* was assigned to the Grand Escort Command. From July 1944, the ship escorted convoys, providing air cover against submarine attack. In November 1944, while escorting a convoy bound for Singapore, *Shinyo* was struck by as many as four torpedoes from USS *Spadefish*. The poorly protected aviation fuel tanks exploded causing a large fire that claimed the ship and most of her crew.

HIJMS SHINYO

Displacement:	17,500 tons
Dimensions:	Length 651ft Beam 84ft Draft 26ft
Maximum speed:	22kts
Radius:	8,000nm
Crew:	948

CONCLUSION

A quick examination of each of the Imperial Navy's principal classes of carriers reveals a mixed bag of success and failure. As the Navy's initial attempt at flying aircraft from the decks of ships, *Hosho* proved a success, as she was used to successfully introduce a number of new technologies and procedures into fleet service. *Akagi* and *Kaga* must also be seen as successful conversions as they provided the backbone of the First Air Fleet's striking power during the initial stages of the war. The *Soryu* class epitomized the Imperial Navy's desire to create a fast carrier with a large air wing at the expense of protection. *Soryu* and *Hiryu* lived up to their designers' promise, providing a powerful striking force but proving unable to survive damage in their only clash with enemy carriers.

In the *Shokaku* class, Japanese carrier design reached its zenith. Both ships proved very tough and capable units in action. At the time of their introduction in late 1941, they were the most well-balanced and powerful carriers in the world. The wartime-built fleet carriers were not as successful. *Taiho* was certainly a fine design, but was clearly not one that could be repeated in sufficient numbers to allow the Imperial Navy to sustain a campaign against the US Navy. The *Unryu* class was a design conceived with ease of construction in mind. However, it was actually a step back, as it possessed little protection, and by 1944, the size of its air group compared unfavorably with those of the new US Navy fleet carriers already in service. The final fleet carrier, *Shinano*, was an anomaly but one that possessed considerable potential. However, by the time of her commissioning, she was irrelevant. The most telling comment regarding the Imperial Navy's fleet carrier construction program was that only five ships entered service. Compared with the 17 fleet carriers built by the US Navy during the war, this was clearly inadequate.

Japanese pre-war plans for preparing merchant and auxiliary ships for conversion into carriers was also a mixed success. While the program was successful in providing 11 ships, these were generally not of a standard to be successful in fleet service. The most useful conversion was the *Hiyo* class. For the Imperial Navy, they were important additions to its carrier force, as they came immediately after Midway. Generally, these ships offered the capability of *Hiryu* but with a lower speed and reduced protection. As the only ships converted from merchants to act as fleet carriers during the war, they must be judged as a successful conversion. The five ships converted from auxiliaries into light carriers generally proved useful in service with the exception of *Ryuhō*. However, even the more successful conversions could operate only a small number of aircraft, and, while maneuverable, were largely unprotected.

The Imperial Navy's five escort carriers rendered little useful service aside from acting as aircraft ferries. Not surprisingly, with no catapults and insufficient speed, they were a failure in their envisioned role as fleet units. Even used in a more suitable role as convoy escorts they proved a failure. The contributions of the Imperial Navy's five escort carriers contrast miserably with the key roles played by the over 125 escort carriers that entered service in the Royal and US Navies.

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COLOR PLATE COMMENTARY

A: PRE-WAR IMPERIAL NAVY CARRIERS

This plate shows the Imperial Navy's first fleet carriers. All Imperial Navy ships were painted in a dark navy gray. The basic shade was made up of a 75 percent white/25 percent black blend with a blue tint (this is very similar to the current color of modern Japanese Maritime Self-Defense Force ships). Each of the major naval depots in Japan unintentionally used a slightly different shade of the basic dark gray color. Maizuru was the lightest with Kure, Yokosuka, and Sasebo each becoming more dark. Later in the war as material shortages increased, the base color for all carriers became more silver gray in tint.

Imperial Navy carrier flight decks were covered by wood planking that was left in its original color. Any area not covered in wood was painted in the basic dark navy gray color, including aircraft elevators. The flight deck was marked to assist in aircraft take-offs and landings. On the forward section of the flight deck on the centerline were six white lines radiating out at ten-degree intervals. This was used to determine wind direction with the help of a steam vent located on the forward end of the flight deck. The centerline stripe ran the entire length of the flight deck and had embedded lights to aid in night landings. The centerline stripe was usually flanked by two other stripes that could be solid or dotted. A distinctive ship identification marking was painted in white. For most carriers this was located on the rear part of the deck on the port side and consisted of the first letter or syllable of the ship's name rendered in *katakana* figures. Many carriers also had a white circle painted on the rear section of the flight deck in the area of the rearmost arresting wires. This was provided as an aiming point for aircraft during recovery. The extreme aft section of the flight deck was marked with a number of white and red stripes to assist the pilot in judging his final approach during landings.

1. The top view shows *Akagi* as it appeared at the start of the Pacific War. Note the small port-side island, one of only two instances of a carrier not having its island placed on the starboard side.

2. This view shows *Kaga* in December 1941. The ship retained this appearance until its loss, apart from the addition of a large red circle on the flight deck for the Midway operation. As with *Akagi*, its non-carrier origin is obvious. The small island has been placed back on the normal starboard side. Also evident is the heavy anti-aircraft armament and the casemate-mounted 8in guns aft near the waterline.

3. Shown here is *Soryu* as it appeared at the start of the war. As the first Imperial Navy ship designed from the keel up as a fleet carrier, its sleek lines indicate speed, but also an inability to carry heavy protection.

B: HIRYU AT MIDWAY

This plate shows *Hiryu* preparing to launch a torpedo plane strike against the American carrier task force during the battle of Midway on June 4, 1942. Only hours earlier, the First Air Fleet's other three carriers had been struck by US carrier dive-bombers and put out of action. Only *Hiryu* remained unscathed and it was now up to her to salvage the battle for the Imperial Navy. Immediately after the disastrous strike on the Japanese carriers, *Hiryu* launched a strike of 18 D3As

escorted by six A6Ms. The Japanese attack was directed at USS *Yorktown* and succeeded in placing three bomb hits on the carrier at the cost of 13 D3As. Now it was the turn of *Hiryu*'s B5Ns, ten of which are shown ranged on the flight deck. One of these is actually from *Akagi* as indicated by the red stripe around the rear fuselage. The six A6M fighters are first to take off, as they need a much shorter length of flight deck to take off than the torpedo-laden B5Ns. Two of these are from *Kaga*, as evidenced by the two red stripes around the rear fuselage.

Hiryu's torpedo strike attacked *Yorktown* again, which had gotten under way following repairs of the damage inflicted by *Hiryu*'s dive-bombers. Of the ten B5Ns, two scored hits. Only five returned to the *Hiryu*. Before *Hiryu* could launch a third strike with the remnants of its dive-bomber and torpedo squadrons, the ship was attacked by dive-bombers from USS *Enterprise* and hit by four bombs. Damage control parties could not contain the resulting fires and the ship was abandoned. *Hiryu* finally sank the next day. *Yorktown* was later sunk by a Japanese submarine attack on June 5.

Inset 1. An A6M from *Hiryu*'s fighter squadron. From 1941–1943, IJN carrier-based fighters were painted in a light gray color. The cowlings were painted in black as an anti-glare device. A single tail stripe indicated that the aircraft belonged to a section leader. The two blue fuselage bands and the tail code of BII indicated that the aircraft was from *Hiryu*, part of Carrier Division 2. The block of 100 numbers was reserved for fighter aircraft.

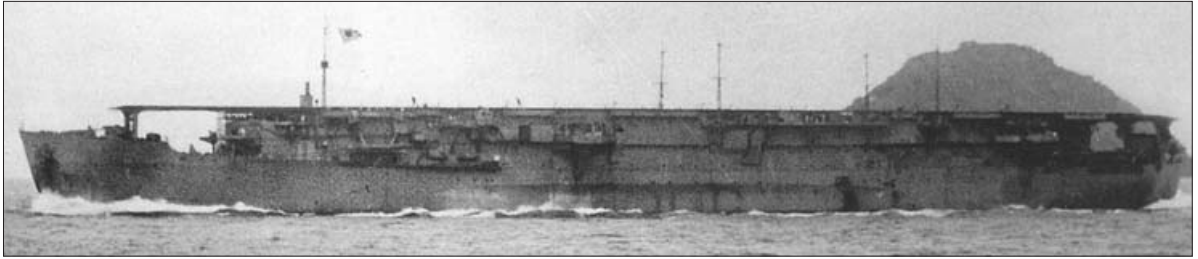
Inset 2. *Hiryu*'s B5N aircraft were painted in a two-color scheme, with black green on the upper sides and light gray on the lower. The aircraft has the same unit and formation markings as the A6M, but in this case it has three tail bands, indicating that it is a group leader's aircraft (in this case Lt. Tomonaga who led the strike on USS *Yorktown*). The 300 block of numbers was reserved for attack aircraft.

C: IMPERIAL NAVY CARRIER CONVERSIONS

This plate shows some of the Imperial Navy's carrier conversions.



Kaiyo clearly showing its mercantile origins. Note the raised Type 21 radar on the flight deck and the port-side Type 94 fire-control director. (*Ships of the World*)



1. This plate shows *Shoho* in May 1942 just before its loss. Note the typical light carrier flush-deck appearance with the downward-facing stack on the starboard side. Also note the narrow flight deck that hindered aircraft operations and limited aircraft capacity to 30. *Shoho* was commissioned with a light anti-aircraft fit and a flight deck that ended well short of the bow. Later on in the war, the four other light carrier conversions received radar, a large number of additional 25mm guns, and had their flight decks lengthened.

2. This plate shows *Hiyo* as the ship appeared in June 1944 before its loss at the battle of the Philippine Sea. The mercantile lines of the *Hiyo* are clearly evident as is the large island with the slanted stack. The ship's anti-aircraft armament has been increased to 18 25mm triple mounts. Three radars are also fitted including a Type 21 on the island, a second Type 21 in a retracting position on the aft port side of the flight deck, and a Type 13 fitted on the mainmast behind the island. The four radio masts shown on the flight-deck edges aft of the island were lowered during flight operations.

D: HIJMS ZUIKAKU

This plate shows *Zuikaku* in her original configuration as she appeared during the Pearl Harbor attack and the battle of the Coral Sea. *Zuikaku* was the second ship of the *Shokaku* class that was ordered in the Third Replenishment Program in fiscal year 1937, the same plan that authorized the two battleships of the *Yamato* class. These carriers were designed without treaty restriction, and, like the *Yamato*, were intended to have no foreign equal.

Zuikaku had a heavy defensive armament with eight Type 89 guns fitted in pairs, each with its own Type 94 director. There were 250 shells provided per gun plus a ready store of 12 additional rounds. The pair of Type 89s aft of the stack were provided with smoke shields. Short-range air defense was provided by 12 Type 96 triple mounts; 2,600 25mm rounds were provided per gun plus an additional 100 rounds for ready use.

Ordnance for the ship's air group included 45 Type 91 torpedoes, 60 1,760lb, 60 1,100lb, 312 550lb, 528 132lb, and 48 66lb bombs. One hoist was provided for moving the large bombs from their magazine to the hangar deck, and another was used for the smaller bombs. Magazines were located on either side of the forward elevator and forward of the most aft elevator. A total of 496 tons of aviation gas was carried aboard. Aviation fuel tanks were located deep inside the ship in the same areas as the magazines.

Zuikaku was fitted with the most powerful machinery available – it delivered a total of 160,000 horsepower on four shafts. Eight boilers were located in eight rooms aligned in two rows and connected to four turbines. The ship's top

***Shinyo* in November 1943 during speed trials. Note the Type 21 radar in its raised position forward of the mainmast. (*Ships of the World*)**

speed was 34 knots; 26 knots could be attained by using cruising turbines.

When commissioned, *Zuikaku*'s crew was listed as 75 officers, 56 warrant officers, 71 petty officers, and 1,458 enlisted men. In October 1942 at the battle of Santa Cruz, the actual ship's complement was 107 officers (including warrants and including the ship's air group) and 1,461 enlisted men and petty officers. Aboard ship, officers were provided with cabin-like staterooms, petty officers had tiered bunks, and enlisted men used hammocks.

On the flight deck, in addition to the Type 4 arresting wires located on the aft portion of the deck, two Kusho Type 3 crash barriers were installed in the area of the island. A windbreak screen was positioned in front of the forward elevator. A seven-ton collapsible crane was fitted aft on the starboard side for handling the ship's boats and aircraft. Three elevators were used to move aircraft from the two hangar decks to the flight deck. Each could move an aircraft from the lower hangar deck to the flight deck in 15 seconds. With time to offload an aircraft, a full circuit took 40 seconds. The 16ft-high upper and lower hangars were each divided into three compartments. For fire protection, each hangar could be divided into six or seven subdivisions by the use of roller-type fire curtains.

The small island had four levels. The first contained the commanding officer's cabin, the operations room, and a ready room. The wheelhouse, radio room and navigation officer's spaces were located on the second level. On the third level were the pilot house, captain's bridge, and the communications office. The fourth level was open and housed the look-outs. Eleven binoculars and two signal lights were positioned on this level, in addition to one of the ship's four Type 94 directors.

Inset 1. Type 89 5in anti-aircraft gun

Inset 2. Type 96 25mm anti-aircraft gun (triple mount)

E: WARTIME CARRIER CONSTRUCTION

1. *Taiho* had a unique appearance with its large island, slanted stack, and distinctive enclosed bow. The ship also features an armored flight deck; it would appear as dark navy gray instead of wood planking. Because of the armored flight deck, only two aircraft elevators are fitted instead of the usual three for a fleet carrier.

2. This plate shows *Amagi* as it appeared in 1945 before its loss. The ship has a typical late-war appearance, with increased anti-aircraft guns and the addition of six 4.7in rocket launchers on the forward flight-deck edge. Radar has

also been fitted, with a Type 21 on the island and another Type 21 on the flight-deck edge on the port side. A Type 13 is mounted on the mainmast. The aircraft and boat crane shown aft was collapsed into the flight deck during flight operations. The ship is in her late-war camouflage scheme, including a disruptive pattern on the flight deck and an anti-submarine scheme on the hull.

3. This plate shows *Shinano* as it appeared in November 1944. The hull employs an anti-submarine scheme. The flight deck was covered with a cement-like substance, so it would appear as light gray. Note the battleship lines of the hull. *Shinano* features the largest flight deck and island of any Japanese carrier. Note the tremendous defensive armament, including numerous triple 25mm triple mounts, eight Type 89 5in dual mounts, and twelve 4.7in rocket launchers. The ship has two Type 21 radars fitted on the island and two Type 13 radars (one on the mainmast and the second on the forward radio mast).

F: TAIHO AT THE BATTLE OF THE PHILIPPINE SEA

This plate shows *Taiho* as it appeared on June 19, 1944 as the ship was participating in Operation "A-Go." *Taiho*, together with *Shokaku* and *Zuikaku*, was assigned to Force "A." *Taiho* embarked the 601st Naval Air Group's *Hikotai* 311 with 27 A6M, 30 D4Y dive-bombers, and 18 B6N torpedo bombers. On June 13, two of each type were destroyed in a landing accident, but the remainder were onboard when *Taiho* sortied with the rest of the Mobile Fleet. On June 19, the Japanese launched their strikes on the US carriers. As the strike of 48 A6Ms, 53 D4Ys, and 27 B6Ns was being launched by Force "A," *Taiho* was being tracked by the submarine USS *Albacore*. At 0810, *Albacore* fired six torpedoes at *Taiho* from 2,000yds. One hit *Taiho* on the starboard side in the area of the forward elevator. This single hit started a chain of events that resulted in a fatal internal explosion at 1432. At 1628, the Imperial Navy's finest carrier sank in its first engagement.

Inset 1. By June 1944, the B5N had been largely replaced by the B6N "Jill." This aircraft was assigned to *Taiho*. Command markings have been simplified. The tail code indicated that

the B6N is an attack aircraft from the 601st Naval Air Group. Note that the *hinomaru* is now encircled by white.

Inset 2. The D4Y "Judy" dive-bomber was a late-war replacement for the D3A "Val." This aircraft was also assigned to *Taiho*. It is also from the 601st Naval Air Group, but the number 220 is drawn from the block reserved for dive-bombers. Moments before the fatal torpedo hit, one of *Taiho*'s orbiting D4Y "Judy" aircraft, piloted by Flight Warrant Officer Sakio Komatsu, spotted the wakes of the incoming torpedoes. Without hesitation, he dove into their path, successfully exploding one.

G: IMPERIAL NAVY CARRIER CAMOUFLAGE

Of all major navies in World War II, the Imperial Navy had the least developed system of warship camouflage. During the early course of the war, a handful of ships, principally light cruisers and auxiliary cruisers, were painted in some variation of disruptive or dazzle camouflage. These schemes were experimental and were not the result of any coordinated effort.

In March 1943, the Yokosuka Navigation School was charged with investigating methods of camouflaging aircraft carrier flight decks. The conclusion of the investigating committee was that camouflage of an exposed flight deck against aircraft was ineffective, but some anti-submarine camouflage measures were recommended. The resulting hull scheme was applied to the Imperial Navy's surviving aircraft carriers in 1944. The pattern was simple and called for the hull to be painted in a bright green base which was over-painted with a false silhouette of another smaller ship in an olive green shade.

Between March and July 1944, another committee took up the issue of carrier camouflage. After testing, it was again determined that camouflage would not prevent a carrier from being spotted by aircraft or confused with another type of ship. However, on the premise that some camouflage was better than nothing, several schemes were prepared for application to carrier flight decks. The schemes were intended to break up the shape of the flight deck and to give the impression to attacking US aircraft that the ship being attacked had gun turrets and other structures and was therefore not a carrier. Each pattern was unique and included black, very dark green, dark green, greenish black, and greenish brown.

1. This plate shows *Zuikaku* as it appeared in the battle of Leyte Gulf in October 1944. For its last battle, it has been painted with a flight deck disruptive scheme. The extended flight deck compared to its sister ship *Shoho* is evident. Also evident are the increased number of 25mm guns and the addition of six rocket launchers along the aft edge of the flight deck.

2. This plate shows the light carrier *Chitose* as it appeared in the battle of Leyte Gulf. The ship is painted with a flight deck disruptive scheme and the anti-submarine hull scheme. *Chitose* was originally a seaplane tender and its original lines can still be seen after its conversion into a carrier.

3. This plate shows escort carrier *Chuyo* in 1944. In addition to the camouflage scheme, the ship also shows the late-war changes made to all escort carriers. The older 4.7in mounts have been replaced by Type 89 mounts and the number of 25mm mounts has also been increased. Type 21 and Type 13 radars have also been fitted.



A B5N attack aircraft takes off showing the flight-deck markings of this Imperial Navy carrier. (US Naval Historical Center)

INDEX

Figures in **bold** refer to illustrations

aircraft

A6M fighters **4, 5, 6, 9, 35, 41, 45, B1**
B5N carrier torpedo aircraft **5, 5, 45, 47, B2**

B6N carrier torpedo aircraft **35, F1**

D3A dive-bombers **3, 5**

D4Y dive-bombers **47, F2**

Albacore, USS **36, 47**

Aleutians **15, 24**

anti-aircraft guns

Type 89 **7–8, 23, 35, D1**

Type 95 director **8**

Type 96 **7, 8, D2**

Archerfish, USS **39**

Argentina Maru (passenger liner) **42**

arresting systems **6**

Barb, USS **41**

Brazil Maru (passenger liner) **42**

Cavalla, USS **20**

Ceylon **12, 17**

Colombo **17**

Combat Information Centers **9**

Combined Fleet **40, 41**

Coral Sea, battle of the (May 1942) **19, 21, 22, 23**

Doolittle Raid (April 1942) **24**

Dutch East Indies **12, 17**

Eastern Solomons, battle of the **15**

Enterprise, USS **12, 14, 17, 20, 45**

Essex-class (US Navy) **17**

fire control directors: Type 94 **7, 23, 45**

First Air Fleet **5, 12, 14**

Carrier Division 2 **17**

Carrier Division 5 **19**

Formosa **33**

Grand Escort Command **40, 41, 43**

Guadalcanal **3, 15, 19–20, 41**

Hornet, USS **20, 24**

Imperial Japanese Navy: carrier development **3–5**

Indian Ocean raid (April 1942) **14, 17, 19**

Izumo Maru (passenger liner) **22**

Japanese carriers: general

aircraft capacity **5**

aircraft launching **5–6**

aircraft recovery **6**

camouflage **47, G**

development **3–5**

escort carriers **40–3**

evaluation of **43–4**

fuel tanks **7**

hangars **6–7**

light carrier conversions **21–4, 33–5**

pre-war **10–21**

radar **8–9**

wartime construction **35–9**

weapons **7–8**

Japanese carriers (by name)

Akagi, HIJMS **11–12, 11, 12, 13, 16, 43, 45, A1**

Amagi, HIJMS **13, 37–8, 38, 46–7, E2**

Aso, HIJMS **37**

Chitose-class **33–5, 34, 35**

Chitose, HIJMS **33–5, 47, G2**

Chiyoda, HIJMS **33–5**

Chuyo, HIJMS **40–1, 47, G3**

Hiryu, HIJMS **16–17, 18, 19, 43, 44, 45, B**

Hiyo, HIJMS **22–4, 44, 46, C2**

Hosho, HIJMS **10–11, 10, 11, 43**

Ikoma, HIJMS **37**

Junyo, HIJMS **9, 22–4, 33**

Kaga, HIJMS **13–14, 14, 15, 43, A2**

Kaiyo, HIJMS **38, 42, 45**

Kasagi, HIJMS **37**

Katsuragi, HIJMS **36, 37–8, 37**

Ryuhō, HIJMS **24, 33, 34, 44**

Ryūjō, HIJMS **14–15, 16**

Shinano, HIJMS **38–9, 40, 43, 47, E3**

Shinyō, HIJMS **42–3, 46**

Shōhō, HIJMS **21–2, 23, 46, C1**

Shōkaku, HIJMS **6, 9, 17–21, 20, 21, 43**

Sōryū, HIJMS **15–17, 17, 43, 45, A3**

Taiho, HIJMS **35–6, 35, 39, 43, 46, 47, E1, F**

Taiyō, HIJMS **40–1, 41**

Unryū, HIJMS **37–8, 43**

Unyō, HIJMS **40–1**

Zuihō, HIJMS **21–2, 24, 47, G1**

Zuikaku, HIJMS **7, 17–21, 20, 22, 46, D**

Java **15**

kamikaze training **42**

Kashiwara Maru (passenger liner) **22**

Kasuga Maru (passenger liner) **40**

Komatsu, Sakio **47**

Kure **38, 39, 42**

Lexington, USS **19, 22**

Leyte Gulf, battle of (October 1944) **7, 21, 22, 24, 34, 38**

Marianas **20**

Midway, battle of (June 1942) **3, 9, 11, 12, 14, 15, 17, 18, 22, 45, B**

Mobile Fleet **36, 38, 47**

New Guinea **19**

Nitta Maru (passenger liner) **40**

Ohka suicide rocket bombs **33, 38**

Operation “A-Go” (June 1944) **36**

passenger liners **22, 40, 42**

Pearl Harbor **12, 17, 19**

Philippine Sea, battle of the (June 1944)

18, 19, 20, 22, 23, 24, 33, 34, 47, F

Philippines **15**

Port Darwin **12, 17**

Port Moresby **19, 22**

Rabaul **12, 19**

radar

Type 13 **9, 9, 24**

Type 21 **9, 9, 35, 45**

Rasher, USS **41**

Redfish, USS **38**

Sailfish, USS **41**

Saipan **20**

Santa Cruz, battle of (October 1942) **22, 24**

Saratoga, USS **15**

Scharnhorst (German liner) **42**

Sino-Japanese War (1937–40) **11**

Solomon Islands **19–20**

Spadefish, USS **43**

Trincomalee **17**

Wakamiya Maru (naval transport) **3–4**

Wake Island **17**

Washington Naval Treaty (1922) **4, 11, 13, 14, 17**

Yamato-class battleships **38**

Yawata Maru (passenger liner) **40**

Yokosuka **24**

Yokosuka Navigation School **47**

Yorktown, USS **17, 19, 22, 45**

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